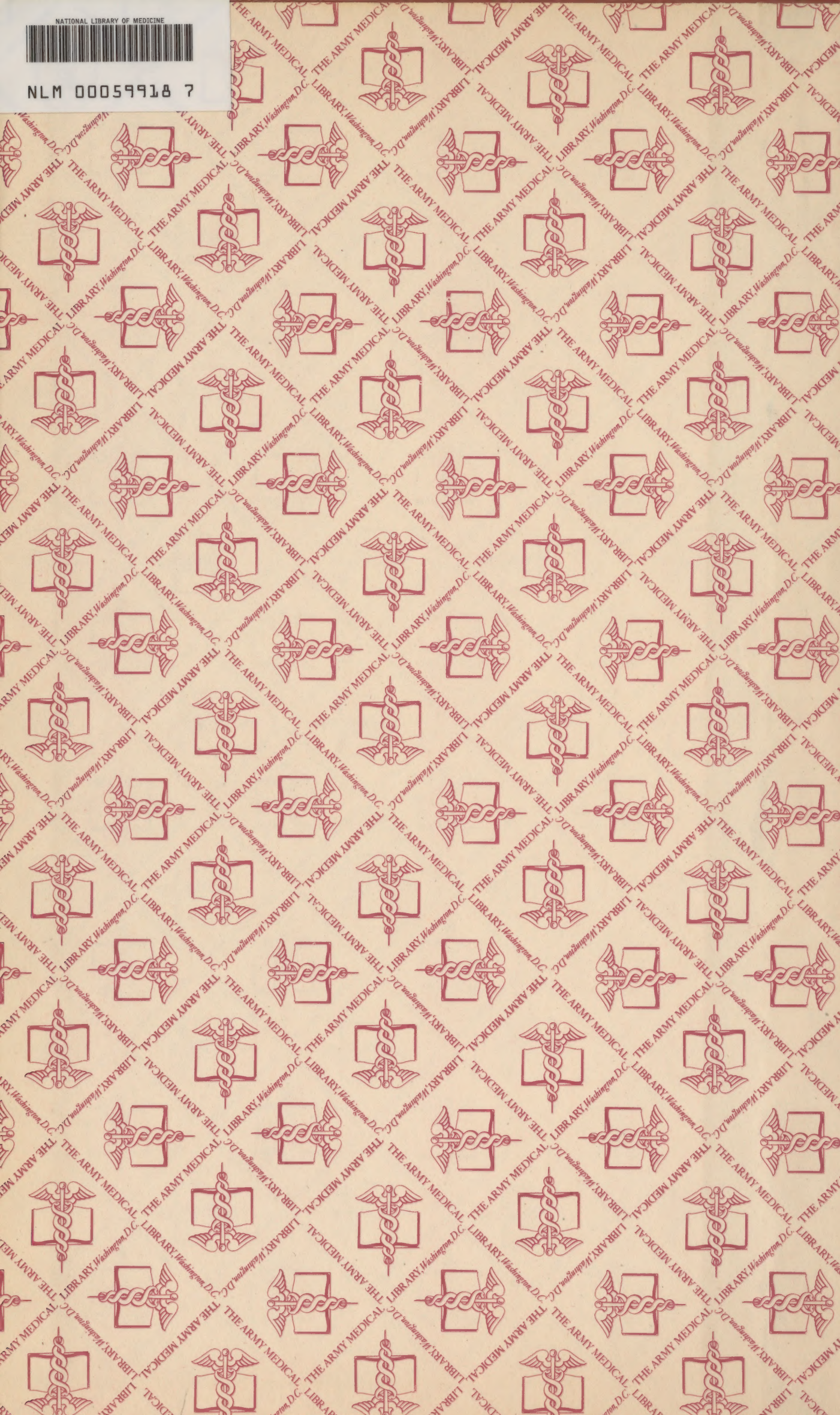




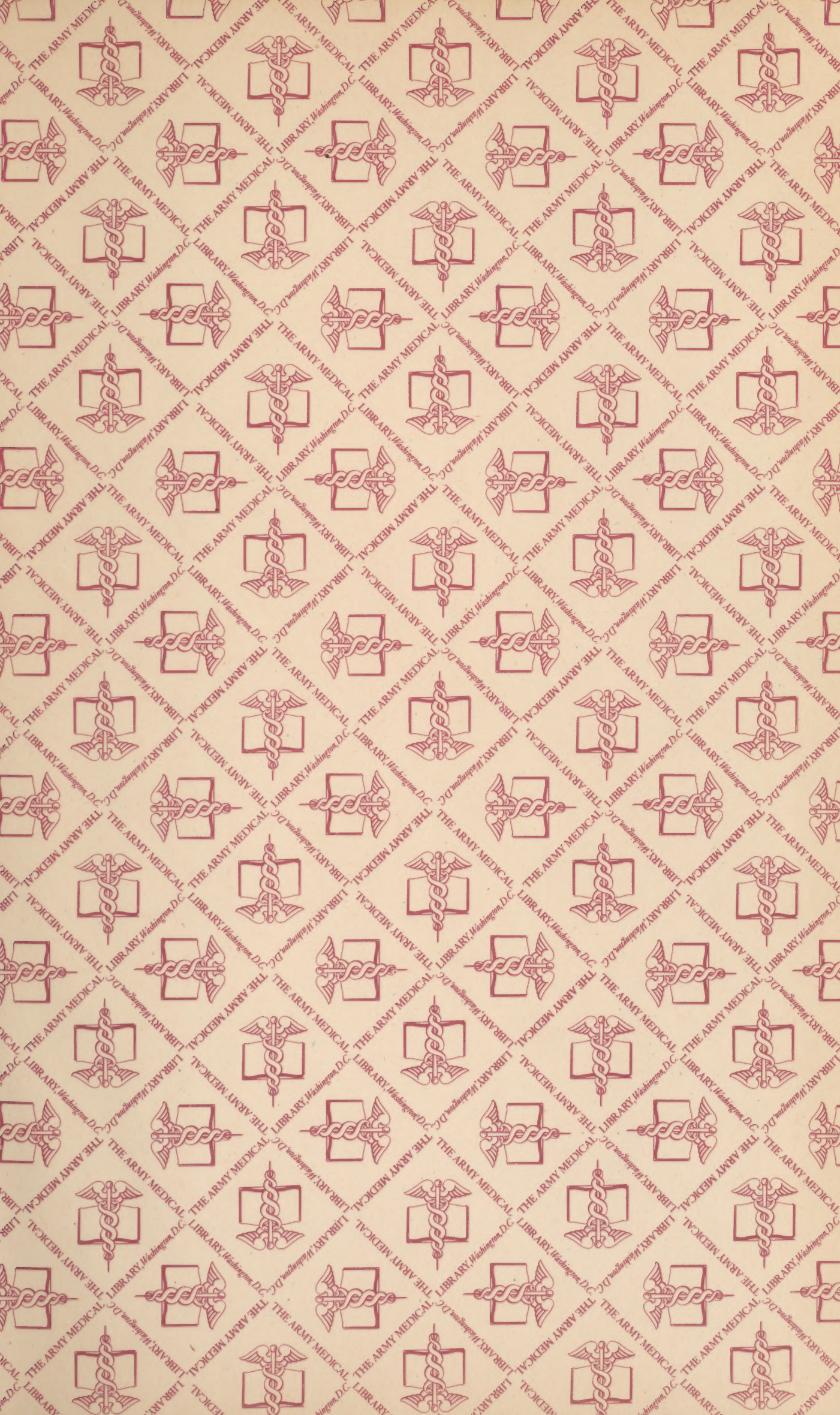




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Army.  
U.S. Surgeon General's Office

THE PREVENTION OF DISEASE IN THE UNITED STATES ARMY DURING

WORLD WAR II

THE PANAMA CANAL DEPARTMENT

EV. 121

Exhibits A, B, and C, to Chapter 14, Volume II

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EXHIBIT A







HEADQUARTERS PANAMA CANAL DEPARTMENT  
Office of the Department Surgeon  
Quarry Heights, Canal Zone

COMPREHENSIVE DRAINAGE SURVEY

MALARIA CONTROL

June 1943







## DRAINAGE SURVEY - MALARIA CONTROL

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- Section 4 - Specific Report on Post of Corozal (Area No. 1).
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(Area No. 2 ).
- Section 6 - Specific Report on Albroom Field (Area No. 3 ).
- Section 7 - Specific Report on Fort Clayton (Area No. 4 ).
- Section 8 - Specific Report on Outlying Area Along Clayton-Albroom  
Highway (Area No. 5 ).
- Section 9 - Specific Report on Fort Kobbe (Area No. 6 ).
- Section 10- Specific Report on Quarry Heights (Area No. 7 ).
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DRAINAGE SURVEY - MALARIA CONTROL

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MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

26 JULY 1943





DRAINAGE SURVEY  
MALARIA CONTROL  
PANAMA CANAL DEPARTMENT

26 JULY 1943

1. PURPOSE. - In order that the incidence of malaria may be held to an absolute minimum in the Panama Canal Department, it is necessary that adequate drainage be maintained. This is a most important factor in the success of a malaria control program. With a view to developing a complete and definitive drainage plan to the end that potential mosquito breeding areas may be eliminated permanently, a comprehensive drainage survey under the direction of the Department Surgeon, assisted by personnel of the Office of the Division Engineer, is being undertaken. This survey will include all the military posts and bases and adjacent territory in the Panama Canal Department. Recognition has been taken of the fact that the closest coordination of drainage plans with those of The Panama Canal is necessary. Accordingly, that agency has been contacted with the purpose in mind of completely integrating the drainage facilities of the Army with those of that agency. Reports for definite areas, describing existing conditions, with recommendations for improvements therein, will be issued from time to time as the survey progresses.

2. GENERAL PROCEDURE. a. Maps of all the posts, bases and outlying areas will be prepared on which will be indicated the existing drainage facilities differentiated in so far as practicable and necessary as to type and in the case of natural streams as to cover and pooling of water.

b. A survey will then be accomplished to determine what work will be necessary, the work to be classified as to immediate need (IN), near future development (NFD) and long range development (LRD).

c. Where construction work other than the simplest ditching or filling is required, a topographic map of the area will be prepared. This map will be platted to a scale of 1" = 40' and where necessary will show contours at two (2) foot intervals, together with invert elevations of pipes, culverts, ditches and other pertinent drainage data.

d. Where a drainage structure except of the most elementary character is proposed, a complete engineering design for it will be prepared. This design will show:

- (1) Drainage area in acres, classified as to surface characteristics.



- (2) Design flow in cubic feet per second, computed from the area served and rainfall data for that particular area on file at The Panama Canal.
- (3) Size, shape, grade and type of drainage structure proposed.
- (4) Capacity and velocity of flow in the structure.

e. A plan and specification for the work in sufficient detail for construction will be prepared.

f. During the period of construction an engineering inspector will be assigned to the project to insure that the work is carried on in rigid compliance with the plans and specifications.

3. GENERAL DRAINAGE SPECIFICATIONS. a. The utmost care will be given to obtaining the maximum grades practicable to insure high velocities and minimum structural requirements. One half round invert tile will be laid to a minimum grade of 0.8% unless there is sufficient reason why such grade can not be obtained. In general, velocities in pipes and culverts shall be not less than 3 feet per second when flowing one half full. Velocities in ditches shall be as high as practicable not to produce excessive erosion.

b. In no case, except to avoid the construction of an inverted syphon for a sanitary sewer, will a pipe line or cable of any description be laid within the flow limits of the ditch. Such pipe lines or cables will be constructed below the flow lines of the ditch. Where it is necessary for a sanitary sewer to cross a ditch, the sewer shall be constructed of cast iron or "Transite" pipe as an initial step toward the elimination of sanitary sewage from open drainage courses. In the construction of new ditches, when existing pipe lines or cables are encountered in the flow line of the proposed ditch, grades of such pipe lines or cables will be adjusted or the alignment or grade of the ditch revised to avoid interference with flow. Pipe lines or cables will not be laid through new or existing culverts. Twelve (12) inches will be the minimum diameter of any sewer conveying surface runoff. Where box culverts are installed, a definite, semi-circular channel will be formed through them.

c. Entrance and outlets of culverts will be shaped and paved in so far as practicable to avoid "potholes" and standing pools of water. At junctions of ditches especial care will be taken that the junction is complete so that erosion will not occur.

d. In the construction of buildings supported on piles or columns, the area beneath the building will be graded before the building is constructed to avoid subsequent pooling of water under the building.

4. SPECIFIC REPORT ON POST OF COROZAL ( AREA NUMBER ONE).

a. Area included. Post of Corozal and outlying area, bounded generally on the north by Corozal Hospital and Cemetery, on the east by Albroom Field, on the south by Diablo Heights and on the west by The Panama Canal. Reference maps M.C. 1 and M.C. 2.

b. Drainage System No. 1. Originates about 800 feet east of the Army Commissary in Corozal and discharges into the Canal just south of Diablo Heights. Main system designated as 1, with branches designated as 1-A, 1-B, 1-C, etc., proceeding upstream.

(1) Ditch 1. This ditch is an improved dirt channel from the Canal to the 6' x 4' culvert under Gaillard Highway and near the new cold storage plant. The daily tide reaches this culvert. Above the culvert the ditch is paved with one-half round invert tile to its termination in a subsoil drain. Recommendations are that:

(a) The ditch be straightened and paved or piped from the 5' x 5' box culvert near the Canal to the 6' x 4' culvert near the cold storage plant. Part of this ditch is on Panama Canal property. (LRD).

(b) A pipe in the flow line of the ditch approximately 100 feet upstream from the 6' x 4' culvert be removed or the ditch grade be raised to clear this pipe which causes the ditch to silt trapping water at the outlet of the 2 - 18" pipes upstream. (NFD).

(c) The adequacy of size of the 2 - 18" pipes be investigated as the flow area is out of proportion to other culverts in the system. Eliminate these pipes entirely, if practicable. (NFD).

(d) The one-half round invert tile be completed at the outlet of the 24" culvert just below junction 1-S and 1-T. (IN).

(e) The grade of the one-half round invert tile at the entrance of the last mentioned culvert be adjusted to eliminate the 6" trap at this point. (IN).

(f) The ditch slopes from the 6' x 4' culvert to the outlet of the 3' x 2' culvert under building 282 be paved. (LRD).

(2) Ditch 1-A. Improved dirt and tidal. Minor drainage. (Panama Canal property). Recommend periodic maintenance.



(3) Ditches 1-B and 1-B-1 to 1-B-4. Improved dirt. Lower end tidal. Recommend new completely paved ditch from point just above intersection of 1-D with 1 along toe of fill and parking area to the area north of the parking area. Regrade 1-B from 1-B-1 to new ditch, 1-B-1, 1-B-2, 1-B-3, and 1-B-4 to discharge into new ditch. Construct sewer from new ditch to edge of engineer area along course of 1-B. Regrade 1-B from 1 to 1-B-1. All of above (IN). (Part of above on Panama Canal property). Complete fill between parking area and existing fill. (LRD)

(4) Ditches 1-C and 1-D. Old ditch channel and tidal. (Panama Canal property). Recommend cleaning and installation of one-half round invert tile for any part above the tidal level. (NFD).

(5) Ditch 1-E. Complete one-half round invert tile to 1 and eliminate large "pothole" at intersection with 1 (IN). Construct new one-half round invert tile ditch from 1-E-1 to existing one-half round concrete at the corner of the MacDonald Tarleton Construction Building. (Panama Canal property) (NFD).

(6) Sewers 1-F, 1-G, 1-I and 1-J. All are sewers. Recommend reconditioning ends at intersection with 1 to prevent erosion and potholes and thorough reconditioning and cleaning of inlets to these sewers. (IN).

(7) Ditch 1-H. Recommend paving with one-half round concrete. (IN)

(8) Ditch 1-L. Recommend cleaning and reconditioning. (IN).

(9) Ditch 1-M. Grass ditch. No change.

(10) Sewer 1-N. Sewer and one-half round invert tile. No change.

(11) Ditch 1-P. Recommend paving with one-half round invert tile from 1 to highway and along highway to high point. (IN).

(12) Ditch 1-Q. One-half round invert tile. No change.

(13) Ditch 1-R. One-half round invert tile. Upper section very flat. Recommend survey to determine if grade can be increased. (NFD). Repair holes in lower section. (IN).

(14) Ditches 1-S and 1-T. Paved and improved. No change.

(15) Ditch 1-U. Dirt ditch with seepage. Straighten and pave with one-half round invert tile to NCO Club. (IN).

(16) Ditch 1-V. Seepage only. Replace with subsoil drain packed in gravel. (IN).

(17) Ditch 1-X. Pave with one-half round invert tile to 1-U-1 then with subsoil drain. (IN).

(18) Ditch 1-Y. Pave with one-half round invert tile. (IN).

(19) Ditch 1-Z. Pave with one-half round invert tile. (IN).

(20) Ditch 1-Q-1. Repair and connect into 1-Q. (IN)

(21) Ditch 1-R-1 and 1-R-2. Pave with one-half round invert tile. (IN).

(22) Ditch 1-R-3. Replace with one-half round invert tile to 12" culvert under street. (LRD).

(23) Ditches 1-U-1 and 1-U-3. Pave with one-half round invert tile. (IN).

(24) Ditch 1-U-2. Install subsoil drain. (IN).

(25) Ditch 1-Y-1. Install subsoil drain. (IN).

(26) Ditch 1-Y-2. Pave with one-half round invert tile. (IN).

(27) Ditch 1-Z-1. No change.

(28) Ditch 1-U-4. Complete with one-half round invert tile to 1-U. (LRD).

(29) Miscellaneous items in area tributary to 1.

(a) Regrade areas south of road loop at rear of cold storage plant. Regrade large fill about 500 feet southwest of plant. (IN).

(b) All pipes and ditches leading from ice plant area into ditch 1 to be completed definitely to water in this ditch. (IN).

(c) Eliminate algae producing water around bldg. 445. (IN).

(d) Eliminate algae producing water around lumber stacks along ditch 1 in engineer area. (IN).

(e) Regrade triangle occupied by "Pan Lock" builders and regrade short sections of one-half round concrete in this triangle. (IN).



(f) Eliminate constant pooling of water near intersection of railroad spur to cold storage plant with main lines. (IN).

(g) Complete one-half round invert tile from drain near southwest corner of bldg 283. (IN).

(h) Deepen and clean 2 minor drains into 1 at a point about 30 feet below the 2 - 18"Ø culverts. (IN)

(i) Connect wash rack drain from near bldg 183 into 1-Q. (IN).

(j) Clean inlet box and culvert at point 60 feet west of bldg 284. (IN).

(k) Install one-half round invert tile from swampy area about 70 feet east of bldg 282 into 1-R. (IN).

(l) Install one-half round invert tile from swampy area about 50 feet southwest of bldg 230 to 1-T-1. (IN).

(m) Regrade area and drain into 1-J the storage yards located around a point 350 feet west of bldg 283. (IN).

(n) Reset where needed and complete to a definite water course or sewer, ditches 1-J-1, 1-J-2, 1-J-3, 1-J-4 and 1-J-5. (IN).

(o) Drain or cover valve box located near 1-J about 400 feet from intersection with 1. (IN).

(p) Pave ditch 1-T-1 with one-half round invert tile. (IN).

c. Drainage System No. 2. Ditch 2. Improved dirt. Tidal to 2-C. Recommend survey and regrading of ditches 2 to junction 2-F, 2-C to junction 2-C-2, 2-C-1 2-D and 2-E with a view to obtaining steeper grades in the upper reaches and tributaries. Regrade ditches above 2-F to discharge into new ditch proposed under 4 b 3. Regrade ditch 2-C above 2-C-2 and ditch 2-C-2 to discharge into ditch 3. All of above (IN). (Part of above on Panama Canal property).

d. Drainage System No. 3.

(1) Ditch 3. Improved dirt. Not subject to daily tide. Recommendations are that:

(a) A new paved ditch or sewer be constructed from a point 500 feet above 3-C to near the end of the existing twin 4' x 4' box culvert under Gaillard Highway on line 5. Flow line to be held low enough to drain same area as this culvert to permit future drainage into it if required. (IN).

(b) The two existing 8" culverts under the railroad near the Canal be replaced by a new culvert of adequate size. (IN).

(c) The existing ditch be regraded and paved or piped from the Canal to 3-A. (LRD). (Part Panama Canal).

(d) The existing ditch be regraded and paved or piped from 3-A to Gaillard Highway. (IN).

(2) Ditches 3-A, 3\*b, 3-B-1 and 3-B-4 be regraded and paved. (NFD)

(3) That a complete paved drainage system for the road to the radio transmitter station be constructed and that 3-D be drained into this. (NFD).

(4) That the entire area bounded by the Canal, the Ordnance Depot, Gaillard Highway and the Engineer Depot, and ditch 1 be ditched with minor ditches to the main ditches and regraded as required to fill all ruts, holes, depressions, etc. (NFD).

(5) Remove or reset to prevent trapping of water the two 12" culverts under an abandoned road about 50 feet west of bldg 34. (IN)

(6) Fill large hole in road shoulder in front of bldg. 34. (IN)..

(7) Regrade areas at west end of bldg 196 and back of bldg 34. (IN).

(8) Connect small drainage pipe from back of bldg 34 into sewer. (IN).

(9) Drain seepage area at northwest corner of bldg 34. This water may be due to a sewer leaking. (IN).

(10) Repair ends of culvert in 3-E near southwest corner of bldg 196 (IN).

(11) Clean 10" line immediately above last mentioned culvert. (IN). Replace with one-half round concrete. (LRD).

(12) Regrade 3-E-2 to obtain steeper grades, if practicable. (LRD).

(13) Gravel or regrade around bldg 37 to avoid water pooling. (IN).

(14) Provide drainage for water standing along north side of bldg 187. (IN).

(15) Adjust grade on 3-F at subsoil drain between bldgs 44 and 83 to get complete drainage. (NFD).



(16) Pave 3-F with one-half round concrete between junction with 3-F-1 and the next 6" culvert. (IN).

(17) Investigate 6" sections of 3-F to determine adequacy of size. (NFD).

(18) Install one-half round invert tile along east side of Gaillard Highway from opposite Finance Office to bldg 197. (IN).

e. Drainage System No. 4.

(1) Ditch 4. Improved dirt. Daily tide does not inundate. Recommend lowering and replacement of existing 18" culvert which is trapping water in ditch. Culvert is now in deteriorated condition. (IN). Regrade to 4-B to obtain definite flow. (IN).

(2) Connect junction of 4 and 4-B with underground 6' x 6' drain No. 5. This will permit a lower outfall point for 4-B and 4 above this point. Regrade 4 and 4-B to eliminate water pooling. Connect 4 with ditch proposed under 4d-1a. (IN).

(3) Pave 4 above 4-B junction and 4-B with one-half round invert tile. (LRD).

f. Drainage System No. 5.

(1) Drain 5. This drain is a box culvert from the Canal to Gaillard Highway and partly paved and partly one-half round invert tile above that point. Recommendations:

(a) Pave ditch slopes from 5-K to 5-L and from 5-V to 5-S. (NFD).

(b) Reshape entrance floor of twin 4' x 4' culvert under Gaillard Highway to prevent pooling. (NFD).

(c) Repair holes in bend near bldg 241. (IN).

(d) Reshape and regrade section from just above 5-N to 5-P to prevent pooling under culvert caused by pipe across flow line of ditch. (IN).

(e) Construct new one-half round invert tile ditch from a point on 5 about 50 feet above 5-V junction north to the Corozal Hospital property line, then parallel to this property line to a point about 70 feet east of the end of the new building being constructed in this area. Construct intercepting ditch to 5-Q and 5-V and grade this area to the new ditches. (IN). Ditches 5-X and 5-Y will be extended to the new ditch. (IN). (Panama Canal property).

(f) Construct new one-half round invert tile ditch from a point on 5 about 300 feet above 5-R junction, in a northeasterly direction through a draw now impounding water to a point where the Corozal Hospital - Post of Corozal property line intersects the west ditch line of the Corozal - Clayton Highway . Connect wash rack drainage to ditch. (IN).

(2) Ditch 5-B and tributaries. Recommendations.

(a) Repair upper end of 24" culvert in 5-B under road to Ordnance Depot. (IN).

(b) Construct new sewer or one-half round invert tile ditch from junction box now holding water located a few feet northwest of bldg 94 to roof drain around motor parts warehouse. (IN).

(c) Complete roof drains from temporary warehouses "A", "B" and "C". (IN).

(d) Install one-half round invert tile from road at north end of temporary warehouse "B". (IN).

(e) Repair junction of 5-B with ditch 7-F. (IN).

(3) Ditch 5-C and tributaries. Recommendations.

(a) Complete with one-half round invert tile unpaved section of 5-C under building 26 and regrade upper section so that it will drain through culvert at corner of building 26. (IN).

(b) Install one-half round invert tile on upper end of 5-C-1, with culvert under road and inlet box near corner of building 100. (IN).

(c) Drain road loop around building 17 with one-half round invert tile and culverts into 5-C-2. (IN).

(d) Regrade area between buildings 10 and 53. (IN).

(4) Ditch 5-E. Complete with one-half round invert tile to culvert. (IN).

(5) Ditch 5-F. Regrade to eliminate pockets. (IN).

(6) Ditch 5-H and tributaries. Recommendations:

(a) Install one-half round invert tile or subsoil drain to seepage area 60 feet west of bldg 47. Fill ruts in this area. (IN).

(b) Install subsoil drains to seepage areas in area about 200 feet west of bldg 47. (NFD).



(7) Ditch 5-J and tributaries. Recommendations.

- (a) Reshape entrance to culvert in 5-J at intersection with 5 to avoid pooling. (NFD).
- (b) Repair holes in 5-J along entire section. (IN).
- (c) Lay new one-half round invert tile from 5-J to a seepage area in rear of bldg 113. (IN).
- (d) Deepen and lay new one-half round invert tile in short seepage ditches west of bldg 114. (IN).
- (e) Fill large holes west of tennis court 102. (IN).
- (f) Construct new one-half round invert tile ditch from end of 5-J-2 to system of dirt ditches south of bldg 77. These ditches have no outlet except seepage or possible partially plugged subdrain. Complete this system of ditches with one-half round invert tile for those conveying storm water and with subsoil drains for those that are seepage ditches only. (NFD).
- (g) Pave slopes 5-J to 5-J-2. (LRD).

(8) Ditch 5-L and tributaries. Recommendations:

- (a) Straighten and pave 5-L from 5 to the recently constructed tile drain near the Albrook Field boundary. Suggest direct route from 4' x 4' twin culvert under Gaillard Highway to 2' x 4' culvert near bldg. 71. (LRD).
- (b) Repair several seepage holes in 5-L from opposite building 120 to end. (IN).
- (c) Complete roof drain from building 326 and connect a kitchen drain from it to the sewer. (IN).
- (d) Repair holes in bottom of 5-L-1 about 50 feet above junction with 5-L. (IN).
- (e) Entire ditch along north side of road in front of buildings 171, 172, 144, 146 and 148 very flat, full of holes and pooling water. Replace with new one-half round invert tile. (NFD).
- (f) Pave with one-half round invert tile new road ditches on north side of road in rear of bldgs 144 and 146. (NFD).
- (g) Complete junction of 5-L-2 with 5-L. (IN).
- (h) Construct new one-half round invert tile ditch from area between bldgs 61 and 136 to 5-L. (IN).

(i) Construct new one-half round invert tile ditch from out-let of 2' x 4' culvert in 5-L along south side of road west to street intersection, (IN).

(j) Construct new sewer from inlet of 2' x 4' culvert in 5-L along north side of road west to street intersection. (IN).

(k) Repair ends of 2.5' x 5' culvert in 5-L-5. (IN).

(l) Complete with one-half round tile invert ditch 5-L-5-A. (IN).

(m) Replace 5-L-5-B with new one-half round invert tile or subsoil drain. (IN).

(n) Fill low area in V between 5-L and 5-L-6. (IN).

(o) Provide roof drainage from bldg 149. (IN).

(p) Replace 5-L-11 with one-half round invert tile and divert seepage area now drained by 5-L-6 into it. (IN).

(q) Regrade 5-L-8 to drain and repair junction with 5-L. (IN).

(r) Replace 5-L-7-A and 5-L-7-D with one-half round invert tile and drain seepage area between them. (IN).

(s) Deepen and regrade 5-L-7-B. (IN).

(t) Repair holes in 5-L-7-C and complete with one-half round invert tile. (IN).

(u) Replace with one-half round invert tile, 5-L-9 system complete to the two 12" culverts in front of commanding officer's quarters. (IN).

(v) Lay new one-half round invert tile from a point in 5-L about 300 feet above 5-L-9 to a seepage area about 100 feet southeast of the commanding officer's quarters. (IN).

(w) Drain seepage area in V between 5-L and 5-L-9 into 5-L with one-half round invert tile. (IN).

(x) Drain seepage area near end of 5-L-10 into 5-L. (IN).

(y) Regrade area around commanding officer's quarters. (IN).



(9) Ditch 5-N. Pave slopes from 5 to next 24" culvert. (LRD).

(10) Ditch 5-R. Reshape upper end 2 - 24" culverts to prevent pooling. Install subsoil drain in seepage area near end of culvert. (IN).

(11) Ditch 5-S. Eliminate holes formed by seepage water just above 48"  $\emptyset$  culvert. Eliminate seepage area about 50 feet southwest of theater with one-half round invert tile and subsoil drains into 5-S. Eliminate water pooling around small pumping station at rear of theater by draining into 5-S. (IN).

(12) Ditch 5-S-1. Complete one-half round invert tile to next highway culvert. (IN).

(13) Install one-half round invert tile and road culvert for road drainage ditches along east side of road to Albrook Field at a point about 500 feet west of the theater. Drain into 5-L. (NFD).

(14) Fill large holes about 100 feet west of inlet of 2 - 24" culverts in 5-R. (IN).

(15) Eliminate seepage holes around roof drain and regrade roof drain, mess hall, in front of new barracks. (IN).

(16) Ditch 5-Z and tributaries. Recommendations:

(a) Repair holes near junction with 5. (IN).

(b) Reshape upper end of 2 - 24"  $\emptyset$  culverts to eliminate pooling. (IN).

(c) Eliminate holes along side of 5-Z from last mentioned culvert to opposite bldg. 178. (IN).

(d) Install one-half round invert tile in ditch 5-Z-3. (NFD).

(e) Straighten and pave slopes of 5-Z to 5-Z-3. (LRD).

(17) Complete one-half round invert tile roof drains for building 24. (IN).

(18) Install roof drainage system for bldgs 242 and 243. (IN).

(19) Install one-half round invert tile from 5-Z to roof drain in barracks "M". (IN).

g. Drainage System No. 6. Recommendations:

(1) Install one-half round invert tile for ditch 6 to where culvert begins. (LRD).

(2) Install one-half round invert tile in ditch 6-A. (LRD).

h. Drainage System No. 7.

(1) Ditch 7. Recommendations:

(a) Install one-half round invert tile and stabilize slopes from Canal proper to 7-A. (IN).

(b) Complete junctions of 7-B, 7-C, 7-D and 7-E with 7 to eliminate potholes. (IN).

(2) Ditch 7-A and tributaries. Recommendations:

Install one-half round invert tile in 7-A-1, upper end of 7-A and 7-A-3. (LRD).

(3) Ditch 7-E. Very flat grade. Regrade, relaying with one-half round invert tile. (IN).

(4) Ditch 7-F and tributaries. Recommendations:

(a) Complete one-half round invert tile from 7-F-1 to next 24" culvert. (IN).

(b) Install one-half round invert tile around planing mill or otherwise eliminate dirt ditches. (IN).

(c) Complete one-half round invert tile along south side of bldg 227. (IN).

(d) Regrade and replace as required with one-half round invert tile upper sections of 7-F-2 around bldg 224. (IN).

(e) Extend 7-F-2-A with one-half round invert tile to drain area northwest of bldg 234. (IN).

(f) Extend, regrade and complete with one-half round invert tile ditch 7-G. (IN).

(g) Regrade and gravel area east of planing mill. (IN).

(h) Provide roof drainage for bldgs 288 and 289. (IN).

(i) Regrade area west of bldgs 288 and 289. (IN).



- (j) Regrade area west of bldg 260. (IN).
- (k) Fill hole around fire hydrant east of bldg 258. (IN).
- (l) Regrade area south of bldg 267. (IN).
- (m) Regrade area northwest of bldg 234. (IN).

1. Drainage System No. 8.

Ditch No. 8. Install one-half round invert tile from Canal to upper end and connect in south end of roof drainage system for Quartermaster storehouse. (IN).

1. Drainage System No. 9.

(1) Ditch 9. Recommendations:

Complete paving slopes from 9-C to outlet of 36" culvert near 9-J. (IN).

(2) Ditch 9-C. Recommendations:

(a) Pave with one-half round invert tile and extend from 9-C-1 along the toe of the existing fill to a point about 300 feet north of the north end of the Quartermaster storehouse. (IN).

(b) From the last mentioned point and a point west and about the midpoint of the quartermaster storehouse construct and pave with one-half round invert tile a new ditch, cutting it directly to the Canal about opposite the hardware storehouse. (IN).

(3) Ditch 9-C-1. Replace with one-half round invert tile to a point at the toe of a proposed fill. (IN). Complete fill in area north of hardware storehouse to form smooth toe line. (LRD)

(4) Construct new one-half round invert tile ditch from 9 to toe of fill about half way between 9-C and 9-D and parallel to 9-D. (IN).

(5) Ditch 9-D. Regrade and install one-half round invert tile. (IN).

(6) Ditch 9-E and tributaries. Recommendations:

(a) Replace upper end of 9-E with one-half round invert tile. (IN).

(b) Regrade and replace 9-E-1 with one-half round invert tile. (IN).

(c) Regrade and replace 9-E-3 with one-half round invert tile. (IN).

- (7) Ditch 9-F. Fill and abandon. (IN)
- (8) Ditch 9-G. Fill between 9 and 9-E and install one-half round invert tile above 9-E. (IN).
- (9) Ditch 9-H and tributaries. Fill 9-H between 9 and 9-E. Fill 9-H-1 between 9 and 9-E and install one-half round invert tile above 9-E. (IN).
- (10) Ditch 9-K. Replace with one-half round invert tile. (IN).
- (11) Lay new one-half round invert tile in ditch 9-L. (IN).
- (12) Lay new one-half round invert tile in ditch 9-M. (IN).
- (13) Extend 9 with one-half round invert tile between R.R. and laundry. (IN).
- (14) Regrade and gravel area between laundry and building 300. (IN).
- (15) Repair and regrade 9-P system to eliminate water at entrance to culverts. (IN).
- (16) Install inlet box or otherwise drain street intersection northwest of building 267. (IN)
- (17) Lay new one-half round invert tile from 9 along old creek channel toward 10-A-1. (IN).

k. Drainage System No. 10.

- (1) Ditch No. 10. Recommendations:
- (a) Remove 36" culvert at Canal bank. (LRD).
- (b) Regrade, straighten and pave from Canal to Gaillard Highway. (LRD). (Part Panama Canal property).
- (2) Ditch 10-A and tributaries. Recommendations:
- Complete unpaved sections with one-half round invert tile. (IN).
- (3) Ditch 10-C. Pave with one-half round invert tile. (Panama Canal property. (LRD).
- (4) Ditch 10-D. Pave sides to culvert at Gaillard Highway. (Panama Canal property). (LRD).



(5) Ditches 10-D-1, 10-D-2 and 10-D-3. Pave sections not now paved with one-half round invert tile. (Panama Canal property). (NFD).

(6) Ditch 10-E. Pave sides (Panama Canal property). (LRD).

(7) Ditch 10-E-1. Pave with one-half round invert tile from 10-E to first 20" culvert under access road. (LRD). Fill depressions in, eliminate 20" culvert and pave with one-half round invert tile section from 20" culvert under access road to end of bldg 251. (IN).

(8) Fill depressions in ditches between bldgs 251 and 182. (IN).

(9) Regrade R.R. ditch alongside bldg 181. (IN).

(10) Complete roof drain from fire and guardhouse to point of definite disposal. (NFD).

(11) Regrade and pave with one-half round invert tile highway ditch on east side of Gaillard Highway from 10-E to opposite Quartermaster access road. (IN).

Recommended \_\_\_\_\_  
Captain, Sanitary Corps

Approved \_\_\_\_\_  
Colonel, Medical Corps

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_





Deputy Department Commander \_\_\_\_\_







# — LEGEND —

-  1/2 ROUND INVERT TILE DITCH
-  FULL CONCRETE DITCH
-  DIRT DITCH
-  15" CULVERT

NOTE: Notations in circles thus (b2) refer to subdivisions of section 4 of accompanying report

SCALE: Approx. 1:2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
COROZAL, C.Z

OFFICE OF THE DEPT. SURGEON	APPROVED
RECOMMENDED <i>Wm. L. Hamilton</i> CAPT., SAN. CORPS	ASST. CHIEF STAFF G-4
APPROVED <i>Wm. C. Pope</i> COL., MED. CORPS	DEPUTY DEPT. COMMANDER
JUNE 1943	DRWG NO MC-1







~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- 18" CULVERT
- TILE DITCH

NOTE: Notations in circles thus refer to subdivisions of Section 4 of accompanying report

SCALE: Approx. 1:2400

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL COROZAL C.Z.	
OFFICE OF THE DEPT. SURGEON RECOMMENDED  CAPT. W. L. M. L. M.	APPROVED  ASST. CHIEF STAFF G-4
APPROVED  COL. W. L. M. L. M.	DEPUTY DEPT. COMMANDER
JUNE 1943	DRWG NO. MC-2



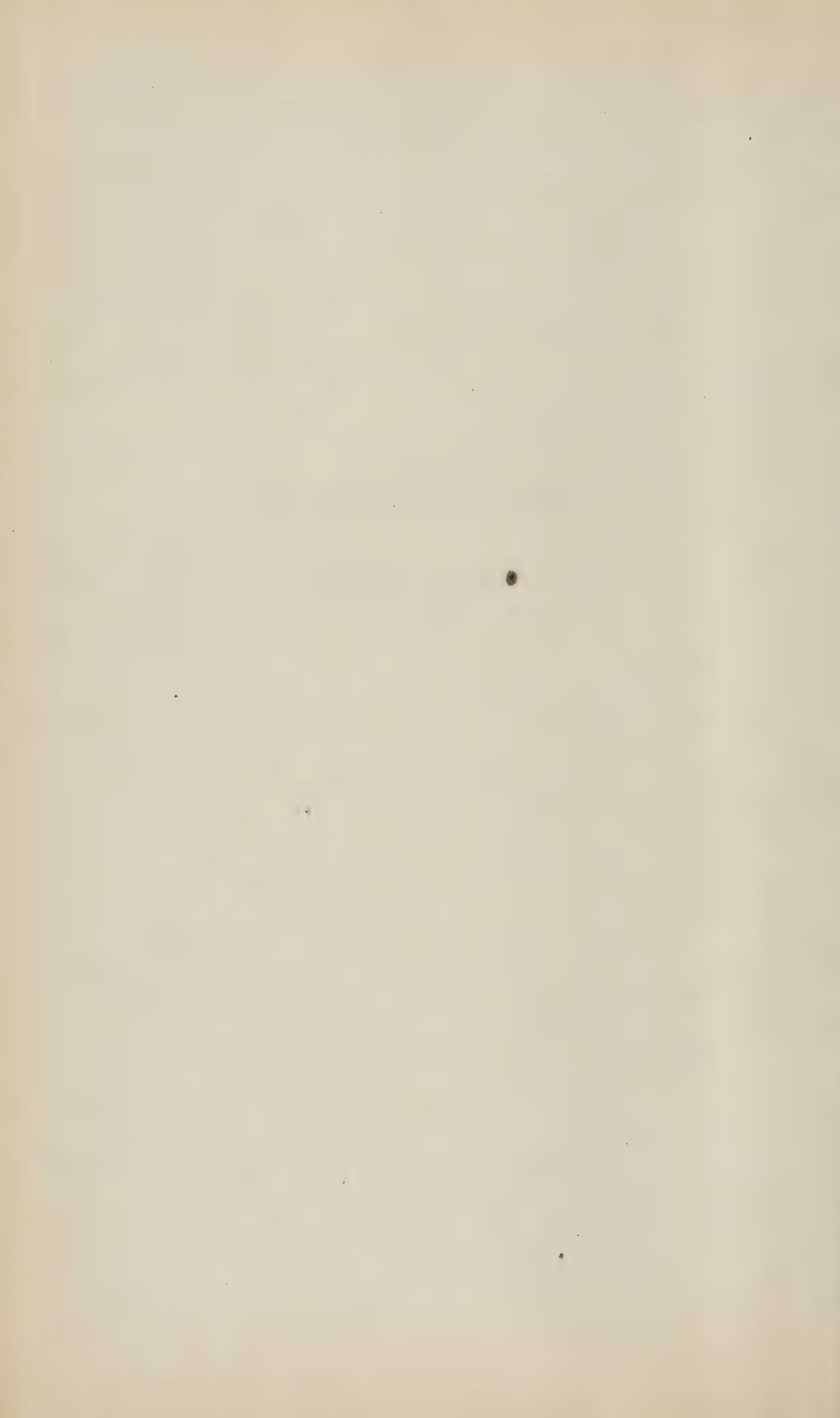


CONTINUATION OF  
MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

AUGUST 1943





5. SPECIFIC REPORT ON COROZAL HOSPITAL - CEMETERY SECTION (AREA NO. 2).

a. Area included. Corozal Hospital and Cemetery and outlying area. Reference Map - M.C. 3.

b. Drainage System No. 5.

(1) Ditches 5-N and 5-P have low spots about opposite ditch 5-X. Recommend diversion one-half round invert tile ditch and culvert from 5-N and 5-P to new ditch along property line proposed under 4 fle. (Panama Canal property). (NFD).

(2) Ditch 5-R and tributaries.

(a) Repair and reshape 5-R from 2-24" culverts to end. (Panama Canal property.) (IN)

(b) Straighten and pave with one-half round invert tile 5-R-1 to point now paved, 5-R-1-A and 5-R-1-B. Install subsoil drains in seepage areas at upper end of 5-R-1-B. (Panama Canal property.) (IN).

(c) Eliminate by subsurface drains, one-half round invert tile and/ or fill, swampy area in V between 5-R-1 and 5-R-1-A. (Panama Canal property). (IN).

(3) Ditches 5-Q and 5-V. To be connected into new ditch proposed under 4 fle.

(4) Ditch 5-X. Connect into ditch proposed under 5 lb. (Panama Canal property.) (NFD).

(5) Ditch 5-Y. Connect with one-half round invert tile into ditch proposed under 4 fle. (Panama Canal Property.) (IN).

(c) Drainage System No. 10.

(1) Ditch 10. Pave sides from Gaillard Highway to junction with 10-G. Repair, straighten and complete with one-half round invert tile from point about opposite dairy barn to 36" culvert under Clayton-Corozal Highway. (Panama Canal property.) (LRD). Install one-half round invert tile for 50 feet on each end of 36" culvert under Clayton-Corozal Highway. (Panama Canal property.) (NFD). Above the 36" culvert, ditch is well shaded and no development is thought necessary. Eliminate by the use of subsurface drains, one-half round invert tile and/ or fill, the swamp on the south side of the ditch about 200 feet above 10-J. (Panama Canal property.) (IN)

(2) Ditch 10-C and tributaries.

(a) Pave upper end of 21" culvert to avoid pools. (Panama Canal property.) (IN).

(b) Install one-half round invert tile to permanently eliminate pooling in ditch 10-C-1. (Panama Canal property.) (IN).

(3) Ditch 10-D and tributaries.

(a) Complete about 50 feet of unpaved ditch in 10-D just above 6' x 6' culvert under Gaillard Highway and eliminate by the use of subsurface drains, one-half round invert tile and/or fill, the swampy area just west of culvert. (Panama Canal property.) (IN).

(b) Complete about 50 feet of unpaved ditch in 10-D-3 just above 24" culvert under Gaillard Highway and eliminate by the use of subsurface drains, one-half round invert tile and/or fill, the swampy area on both sides of ditch at this point. (Panama Canal property.) (IN).

(c) Install one-half round invert tile in ditch 10-D-4. (Panama Canal property.) (LRD).

(d) Install one-half round invert tile and culvert under road for ditch 10-D from junction with 10-D-5 to end. (Panama Canal property.) (LRD).

(4) Ditch 10-E. Pave end of and open to the subdrain the 12" culvert at junction with 10-E-1. Install removable one-half round invert tile over the top of the existing one-half round invert tile in 10-E from the last mentioned culvert up to and including the fence around the confinement area. This will prevent the continual clogging of this drain with leaves. (Panama Canal property.) (IN).

(5) Ditch 10-G and tributaries.

(a) Install one-half round invert tile in unpaved sections of 10-G and 10-G-5. (Panama Canal property.) (NFD).

(b) Install one-half round invert tile in unpaved sections of 10-G-1 and 10-G-6. (Panama Canal property.) (LRD).

(6) Ditch 10-J and tributaries.

(a) Reshape to prevent peoling the outlet and inlet of the culvert in 10-J at the junction with 10-J-2. (Panama Canal property.) (IN).

(b) Install one-half round invert tile in 10-J-2. (Panama Canal property.) (NFD).



(c) Drain with one-half round invert tile or subsoil drain and/or fill the old ditch channel in section of 10-J between junctions 10-J-3 and 10-J-4. Deepen and clean 10-J for about 80 feet above 10-J-4 junction to eliminate large sunny pool. (Panama Canal property.) (IN).

(d) Straighten and install one-half round invert tile in 10-J from 10-J-4 to end of water. (Panama Canal property.) (LRD).

(e) Fill holes, ruts, etc., in area northeast of 10-J-3 between junction with 10-J and 10-J-3-A. Install one-half round invert tile in 10-J-3 between junction 10-J-3-A and 20" culvert. (Panama Canal property.) (IN).

(f) Install one-half round invert tile in 10-J-3-B and in 10-J-3 from lower 20" culvert to a point about 50 feet above upper 20" culvert. (Panama Canal property.) (NFD).

(g) Install one-half round invert tile in 10-J-4 from junction with 10-J to end of water about one-half way from 10-J to the 18" culvert. (Panama Canal property.) (LRD).

(h) Ditches 10-J-5, 10-J-6 and 10-K are in well shaded areas and practically waterless. No improvement is thought necessary.

(i) Clean and deepen 10-J-4 for about 80 feet above junction with 10-J. (Panama Canal property.) (IN).

(j) Install one-half round invert tile in 10-L from 24" culvert to top of hill. (Panama Canal property.) (IN).

(k) Fill all holes, ruts, etc., in old Corozal road between Corozal Cemetery and Clayton rock quarry. (Panama Canal property.) (IN).

(l) Oil regularly the depression area located on the east side of Gaillard Highway about 1000 feet south of the Cardenas River. There apparently is no economically feasible method of eliminating this pool. A small automatic trash pump, connection into the ground water system, or a culvert constructed under the Gaillard Highway and Panama Railroad are possible solutions.





LEGEND

- 1/2 ROUND INVERT TILE
  - FULL CONC
  - DIRT
- OR
- WATER

NOTE: NOTATIONS IN RECTANGLES THUS, [b4] REFER TO SUB-DIVISIONS OF SECTION 5 OF ACCOMPANYING REPORT

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
COROZAL CEMETERY & VICINITY

OFFICE OF THE DEPT. SURGEON  
RECOMMENDED [Signature] CAPT. MED. CORPS  
APPROVED [Signature] COL. MED. CORPS

ASST. CHIEF STAFF G-4  
DEPUTY DEPT. COMMANDER

21

JULY 1943

DRWS NO. MC. 3





Recommended George W. Hamilton  
Captain, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_

Deputy Department Commander \_\_\_\_\_





MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

28 SEPTEMBER 1943



6. SPECIFIC REPORT ON ALBROOK FIELD (Area Number Three).

a. Area included. Albrook Field and vicinity as indicated on accompanying maps, M.C. 4, M.C. 5 and M.C. 6.

b. Drainage System No. 11 (Rio Maria Sala and tributaries).

(1) Ditch 11 (Rio Maria Sala).

(a) Improve channel and pave invert and side slopes from junction with 12 (Curundu River) to junction with 11-G. Construct new completely paved ditch and culvert from 11-G to a point about 200 feet below 11-H along the general location indicated on Drwg. M.C. 4. Include new culvert under street. Old culverts and channel in this section to be used as overflow with bottom raised and sloped to completely drain during low tide. (LRD).

(b) Pave invert and side slopes from the point 200 feet below 11-H to the 6' x 7' box culvert under the highway and just below junction with 11-S. Eliminate by a smooth bend the V at junction with 11-P and 11-Q. (IN).

(c) Pave invert and side slopes from the 6' x 8' highway culvert to junction with 11-Z. (NFD).

(d) Pave invert and side slopes from 11-Z to next 30" culvert. (IN).

(e) Complete junctions of the several pipes discharging into 11 on the east banks between junctions with 12 and 11-G so that no potholes are formed in ground above Elev. 6.0. (IN).

(f) Recondition junction of 11 and 11-L to eliminate the pooling of water at this point. (IN).

(2) Ditch 11-A. Pave with one-half round invert tile. (LRD).

(3) Ditch 11-B. Install storm sewer from junction with 11-B-1 to 18" culvert and complete fill over it. (IN). Install one-half round invert tile from 11 to 3-18" culverts under street. (LRD).

(4) Ditch 11-C. Complete paving invert and side slopes from 11 to 24" culvert just above 11-C-5. (IN).

(5) Ditch 11-C-1 and 11-C-2. Regrade to eliminate pooling at upper ends and pave with one-half round invert tile. (IN).

(6) Ditch 11-C-3. Complete paving invert and slopes. (IN).



(7) Ditch 11-C-4. Pave with one-half round invert tile. (IN).

(8) Ditch 11-C-6. Install storm sewers and one-half round invert tile to junction with 11-C-6-A. Fill adjacent area and replace with storm sewer of adequate size the existing blocked 8" culvert just below junction 11-C-6-A. (IN).

(9) Ditch 11-D and tributaries. Clean 18" culvert at lower end. (IN) Install one-half round invert tile from 11-D to end of 11-D-1. (NFD). Install one-half round invert tile from 11-D-1 to point on 11-D-1-A, 200 feet upstream from 11-D-1. (NFD). Install one-half round invert tile from 11-D-1-A to point on 11-D-1-A-1, 80 feet upstream from 11-D-1-A. (NFD). Clean and regrade 11-D if steeper grade can be obtained. (NFD).

(10) Ditch 11-E. Complete paving invert and slopes from 11 to 30" culvert just above junction with 11-E-1. Repair and clean upper section. Regrade if this fails to eliminate water pooling. (IN).

(11) Ditch 11-E-1. Complete paving invert and slopes. (IN).

(12) Ditch 11-F. Replace with road inlet box and sewer. (IN).

(13) Ditch 11-G. This ditch is trapped a depth of one foot at the mouth of the 2 - 24" culverts at junction 11-G-5. This condition contributes to the continuous silting up of all the ditches immediately upstream from this point. A 12" sanitary sewer placed squarely in front of one of the 24" culverts further aggravates the situation. It is recommended that a new storm sewer be constructed from the mouth of the 2- 24" culverts across the ball diamond and in the rear of the temporary barracks to junction 11-G-6 with ditch 11-C. Should the section of 11-C from 11-C-5 to 11-C-6 be inadequate, or the invert elevation too high, extend the proposed ditch to junction 11-C-5. Inlet boxes should be installed and the section under the ball diamond and in rear of the temporary barracks should be laid with open joints packed in porous material with the ground surface of all the adjacent areas regraded to drain into the inlet boxes. Sub-surface drains should be installed as required to dry the seepage area in rear of the temporary barracks. The road drainage system at the V, about 500 feet southwest of the temporary barracks, should be completed with one-half round invert tile and drained into the proposed storm sewer. The end of the existing 12" sanitary sewer protruding into the 24" culvert should be removed and connected into the system 100 feet downstream from the entrance to the 2 - 24" culverts. As an alternate to the above proposal, an investigation should be made to determine if the grade of the system above the 2 - 24" culverts can be raised to discharge into the culverts with satisfactory grades maintained upstream. As a second

alternative, the 2 existing 24" culverts may be replaced from their inlets to where they join the original 6' x 5' box culvert. Under any of the proposals, the pooling and seepage area in rear and to the sides of the temporary barracks should be eliminated, together with completing the road drainage system mentioned above. All of the above (IN). From the 2 - 24" culverts at junction 11-C-5 straighten and complete paving ditch with one-half round invert tile to junction 11-C-12. (IN). Pave side slopes of same section. (LRD).

(14) Ditch 11-G-4. Adjust grade to eliminate trap at lower end where this ditch enters the 24" culvert. (IN).

(15) Ditch 11-G-5. Straighten, regrade and install one-half round invert tile in this ditch and its tributaries. (IN).

(16) Ditch 11-G-6. Complete one-half round invert tile in main ditch and to the street drainage system now spilling into it from NCO area. Install one-half round invert tile in ditch 11-G-6-B. Install sub-soil drainage system as required to eliminate pooling around the two springs near junction with 11-G-6-B and at the end of 11-G-6-A. All of above (IN).

(17) Ditch 11-G-7. Clean and repair upper end. (IN).

(18) Ditch 11-G-9. Straighten, regrade and install one-half round invert tile. (IN).

(19) Ditch 11-G-10. Complete with storm sewer and/or completely paved ditch from junction with 11-G to existing sewer at road junction about 1200 feet northeast of Albrook School. (IN).

(20) Ditch 11-G-10-A. Install one-half round invert tile from 11-G-10 to a point about 350 feet from junction 11-G-10. Include the short feeder branches to this line. regrade around outlet of culvert at upper end to eliminate pooling of water. (IN). Install half round invert tile for the remainder of this system.

(21) Ditch 11-G-10-B. Install one-half round invert tile. (IN).

(22) Ditch 11-G-11. Complete 24" storm sewer to 11-G and finish back-filling ditch from 11-G to street. (IN).

(23) Ditch 11-G-12. Straighten and pave invert and side slopes from 11-G to outlet of 36" culvert about 200 feet above junction with 11-G-12-B. Complete upper end of 11-G-12 with one-half round invert tile. (IN).

(24) Ditches 11-G-12-A, 11-G-12-A-1 and 11-G-12-A-1-A. Straighten and install one-half round invert tile. (IN).



(25) Ditch 11-G-12-B. Install one-half round invert tile to culvert about 100 feet above junction with 11-G-12 and replace this culvert. (IN). Straighten and install one-half round invert tile in this ditch above the replaced culvert including the several short branches. (LRD).

(26) Miscellaneous items in areas adjacent to ditches 11-A to 11-G inclusive.

(a) Install definite outlet with one-half round invert tile or storm sewer to eliminate pooling of water around ends of culvert under Gaillard Highway railroad crossover at point about 500 feet east of new cold storage plant. (IN).

(b) Complete 6" sanitary sewer and fill large hole at a point about 150 feet east of the 12" culvert referred to under (a) above. (IN).

(c) Install one-half round invert tile in upper end of 11-C-6-B. (LRD).

(d) Regrade to eliminate several deep ruts, holes, depressions, etc., in the large V area between the upper end of ditch 11-A and the 11-C-6-B, 11-C-6-A system. Repair leaky hydrant in this area. (IN).

(e) Fill old ruts about 100 feet northwest of junction of 11-C-1 with 11-C. (IN).

(f) Fill and/or drain with one-half round invert tile large hole about 50 feet north of junction of 11-E with 11. (IN).

(g) Cover open sanitary sewer manhole about 350 feet east of junction of 11-C-6 with 11-C. (IN).

(h) Extend existing 12" culvert which discharges into a "pothole" about 120 feet west of junction of 11-C-11 with 11-G to discharge to 11-C. (IN).

(27) Ditches 11-H, 11-J and 11-K. Install one-half round invert tile. (IN).

(28) Ditch 11-L. Straighten and pave invert and side slopes from junction with 11 to junction with 11-L-11. (LRD).

(29) Ditch 11-L-2. Install one-half round invert tile from 11-L to end. (NFD).

(30) Ditch 11-L-3. Install one-half round invert tile from 11-L to next culvert and regrade area around inlet to this culvert to avoid pooling. (IN).



(31) Ditch 11-L-4. Install one-half round invert tile and pave side slopes from junction with 11-L to 50 feet upstream from 36" culvert. Drain with one-half round invert tile and/or fill areas on each side of 11-L-4 just above junction with 11-L. (IN). Complete ditch from the point 50 feet above the culvert with one-half round invert tile to existing paved section further upstream. (LRD).

(32) Ditch 11-L-4-A. Install one-half round invert tile. (IN).

(33) Ditch 11-L-4-B. Install one-half round invert tile. (LRD).

(34) Ditch 11-L-5. Install one-half round invert tile from 11-L to next culvert. Above culvert install one-half round invert tile, sub-soil drains and/or fill as required to totally dry up the swampy area and existing dirt ditches for about 200 feet upstream from the culvert.

(35) Ditch 11-L-6. Install one-half round invert tile and pave side slopes from 11-L to the next 24" culvert. (NFD).

(36) Ditches 11-L-6-A and 11-L-6-A-1. Install one-half round invert tile to the two 12" culverts under road. (NFD).

(37) Ditch 11-L-8. Install one-half round invert tile and pave side slopes from 11-L to junction 11-L-8-A. Install one-half round invert tile above junction 11-L-8-A and in ditch 11-L-8-B. (IN).

(38) Ditch 11-L-9. Install one-half round invert from 11-L to next 24" culvert. (IN). Pave side slopes from 11-L to end. (NFD).

(39) Ditch 11-L-10. Install one-half round invert tile from 11-L to 12" culvert under road. (IN).

(40) Ditch 11-L-11. Complete with one-half round invert tile to 11-L. (IN).

(41). Miscellaneous items in areas adjacent to ditches 11-H to 11-L inclusive:

(a) Regrade to eliminate flat section and repair broken sections of the existing paved ditch through the company officers area. (LRD).

(b) Repair and complete roof drainage system for Air Corps and Ordnance warehouse near bank of ditch 11 between junctions 11-H and 11-K. (IN).

(c) Eliminate seepage area northwest of the above mentioned Ordnance warehouse by the use of sub-surface drains and/or one-half round invert tile. (IN).

(d) Eliminate extensive pooling of water in area located about 500 feet west of junction of 11-L and 11 by the use of one-half round invert tile and fill. Fill large deep ruts about 200 feet south of this area. (IN).

(e) Complete backfilling trench and around valve box located about 450 feet northeast of junction of 11-L-3 with 11-L. Cover or drain the box. (IN).

(f) Install one-half round invert tile along west bank of road to storage tank located on hill west of the officers quarters area. (LRD).

(g) Pave or riprap around end of 24" culvert located about 500 feet southwest of junction of 11-L-7 with 11-L. (IN).

(42) Ditch 11-M. Install one-half round invert tile between its two junctions with 11. (IN).

(43) Ditch 11-M-1 and tributaries. Regrade and install one-half round invert tile in this entire system. (IN).

(44) Ditch 11-N. Clean. Regrade if required. (IN).

(45) Ditch 11-P. Regrade, and pave invert and side slopes, resetting, if required, the 36" culvert under the taxiway about 300 feet above junction of 11-P-2 with 11-P. Entire area on both sides of section of 11-P above 36" culvert to be filled. (IN).

(46) Ditches 11-P-1, 11-P-2 and 11-P-2-A. Regrade and install one-half round invert tile. Fill in this area as required to obtain drainage to the ditches. (IN).

(47) Ditch 11-Q. Clean and repair. Regrade if this does not result in definite flow of water. Repair bridge over this ditch at a point about 300 feet below junction with 11-Q-1 so that dirt falling from trucks crossing this bridge does not fall into ditch. Install one-half round invert tile in ditch 11-Q-1, 11-Q-1-A and 11-Q-2. (IN).

(48) Ditch 11-R. Regrade and install one-half round invert tile. (IN).

(49) Complete junction with 11 and stabilize side slopes either by paving or with sod. (IN).

(50) Ditches 11-T and 11-T-1. Regrade and install one-half round invert tile with culvert under the adjacent side road. (IN).

(51) Ditches 11-U, 11-V and 11-W. Complete junctions with 11 and stabilize side slopes either with sod or pavement. (IN).



11. (IN). (52) Storm sewer 11-X. Complete junction with

(53) Ditch 11-Y. Complete paving invert and side slopes from 11 to next 30" culvert. Install 50 feet of one-half round invert tile past upper end of existing paved ditch. (IN).

(54) Ditch 11-Y-1. Eliminate seepage area on north side of ditch about 300 feet above junction with 11-Y by the use of sub-surface drains and one-half round invert tile. (IN).

(55) Ditch 11-Y-3. Pave side slopes or stabilize with sod from inlet to the 2 - 18" culverts just above junction with 11-Y to junction with 11-Y-3-A. (IN).

(56) Ditch 11-Y-7. Eliminate seepage area near junction with 11-Y by the use of sub-surface drains and one-half round invert tile. (IN).

(57) Ditch 11-Z. Pave invert and side slopes from junction with 11 to the culvert under the main highway 200 feet above junction with 11-Z-9. (NFD).

(58) Ditch 11-Z-1 and tributaries. Complete paving invert and side slopes. (IN).

(59) Ditch 11-Z-2. Complete paving invert and side slopes from 11-Z to 11-Z-2-A. (IN).

(60) Ditch 11-Z-3. Pave invert and side slopes from 11-Z to junction with 11-Z-3-A. Install one-half round invert tile for 150 feet above junction with 11-Z-3-A. (IN). Install one-half round invert tile from the 150 foot point to end of water in this ditch. (LRD).

(61) Ditch 11-Z-4. Install one-half round invert tile. (IN).

(62) Ditch 11-Z-5. Install one-half round invert tile from 11-Z to next 24" culvert. (IN).

(63) Ditch 11-Z-6. Install storm sewer or pave invert and side slopes from 11-Z to next 24" culvert. (IN). Install one-half round invert tile from 24" culvert to end. (NFD).

(64) Ditch 11-Z-7. Install one-half round invert tile from 11-Z to end. (NFD).

(65) Ditch 11-Z-8. Straighten, regrade and install one-half round invert tile from 11-Z to end. Regrade and fill adjacent area to drain to this ditch. (IN).

(66) Ditch 11-Z-9. Pave invert and side slopes from 11-Z to next culvert under highway. (NFD).



(67) Miscellaneous items in area adjacent or tributary to ditches 11-L to 11-Z inclusive:

(a) Eliminate water pooling in the entire plane revetment area south of ditches 11 and 11-Q by the use of fill, one-half round invert tile ditches and culverts. (IN).

(b) Fill large deep ruts in "Skeet" shooting area near ditch 11-M. (IN).

(c) Install one-half round invert tile along south side of highway in front of bachelor quarters between ditches 11 and 11-Q-1-A. (IN).

c. Drainage System No. 12 (Rio Curundu and tributaries).

(1) Ditch 12 (Rio Curundu).

(a) Pave invert and side slopes from junction with 11 to existing closed section just above junction with 12-E. Construct access manholes in section from 12-E to 12-G. (LRD).

(b) Straighten and pave invert and side slopes from junction with 12-J to junction with 12-T. Before this is done a detailed hydraulic study is to be made to determine the required size of existing closed section from 12-J to near 12-E. If inadequate this section is to be enlarged. (LRD).

(2) Ditch 12-A. Clean thoroughly. If this does not eliminate the pooling of water, regrade to a minimum grade of 0.3%. (IN).

(3) Ditches 12-B and 12-C. Regrade and install one-half round invert tile. (LRD).

(4) Ditch 12-D. Remove sharp bend at junction with 12 and pave invert to a point 400 feet below junction with 12-D-1. (LRD). Reverse flow of 12-D ditch proposed under 6-C-6 and pave with one-half round invert tile. Above 12-D-2, 12-D will be replaced by new paved ditch. (IN).

(5) Ditches 12-D-1 and 12-D-2. Regrade and pave with one-half round invert tile, including the several short laterals in this area. (IN).

(6) Construct new ditch with one-half round invert tile and concrete side slopes from a point in 12 about 50 feet above 12-E along a line parallel to 12 D and about 60 feet in rear of line of plane revetments to junction of 12-D with 12-D-2. Extend new paved ditch from this point along D to intersection with 12-F. Entire plane revetment area east of proposed ditch and low ground on both sides of ditch to be filled and drained with one-half round invert tile to eliminate the extensive pooling of water in this area. (IN).

(7) Ditch 12-F and tributaries.

(a) From the point where the new paved ditch proposed under 6-C-6 intersects 12-F replace 12-F with new fully paved ditch to a point about 50 feet above junction with ditch 12-F-8. From the latter point construct new fully paved ditch to the 90° bend in 12-F about 120 feet below junction 12-F-5. From the 90° point regrade 12-F and complete with one-half round invert tile to the 36" culvert 150 feet below 12-F-3. (IN).

(b) Ditches 12-F-3 and 12-F-4. Regrade and install one-half round invert tile. (IN).

(c) Ditch 12-F-5. Install one-half round invert tile. (LRD).

(d) From the 90° bend in 12-F about 120 feet below 12-F-5 to the next 2 - 24" culverts, construct fully paved ditch. (IN).

(e) Install one-half round invert tile in 12-F from 12-F-5 to 12-F-8. Remove existing deteriorated 18" and 24" culverts in this section. Continue to tie into new paved ditch at point 50 feet above junction 12-F-8. (IN).

(f) Ditch 12-F-7. Fill and abandon sections not replaced by new paved ditch. (IN).

(g) Ditch 12-F-8. Install one-half round invert tile to end of existing paved section of 12-A.

(h) Regrade ditch 12-F above its intersection with the new ditch proposed under 6-C-6. (IN).

(k) Deepen and regrade the several short branches into 12-F between 12-F-3 and 12-F-4.

(8) Miscellaneous items in area adjacent or tributaries to ditches 12-A to 12-F inclusive.

(a) Fill open water main ditch at a point about 400 feet southeast of junction of 12-E with 12. Cover or drain valve boxes and fill around them. (IN).

(b) Fill and drain with one-half round invert tile the entire plane revetment area northwest of the Pan-American plane hangar. (IN).

(c) Fill the low area adjacent to the west side of the Pan-American plane hangar. (IN).

(9) Ditch 12-G. Straighten and pave invert and side slopes from 5' x 6' culvert under highway about 250 feet below junction 12-C-6 to the 36" culvert under highway about 500 feet above junction 12-G-7. (NFD).



(10) Ditch 12-G-1. Regrade to eliminate pooling of water. (IN).

(11) Ditch 12-G-3. Regrade to eliminate pooling of water. (IN).

(12) Ditch 12-G-5. Clean and repair. Regrade if this does not result in definite flow of water. (IN).

(13) Ditch 12-G-6 and 12-G-7. Straighten and install one-half round invert tile. (IN).

(14) Ditch 12-G-4-A. Pave invert and side slopes above junction with 12-G-4-A-2. If sufficient slope cannot be obtained, reverse flow to drain into 12-G-2. (IN).

(15) Ditch 12-G-4-A-1. Install one-half round invert tile above junction with 12-G-4-A-1-A. (LRD).

(16) Ditch 12-G-4-A-1-A. Install one-half round invert tile and/or storm sewer. (IN).

(17) Ditch 12-G-4-A-2. Complete paving ditch between junction with 12-G-4-A and next 24" culvert. Replace one-half round invert tile between junctions with 12-G-4-A-2-B and 12-G-4-A-2-C. Replace one-half round invert tile just above junction with 12-G-4-A-2-D. (IN).

(18) Ditch 12-G-4-B. Install paved ditch and/or storm sewer for about 00\* feet above junction with 12-G-4. Install one-half round invert tile from this point to end of ditch on top of hill. (IN).

(19) Ditch 12-G-4-B-1. Install one-half round invert tile to junction with 12-G-4-B-1-A and grade borrow pit on each side to drain to it. (IN). Install one-half round invert tile above junction with 12-G-4-B-1-A. (LRD).

(20) Ditch 12-G-4-B-2. Install one-half round invert tile and connect in wash racks. (IN).

(21) Ditch 12-G-4-B-2-A. Install one-half round invert tile. (LRD).

(22) Miscellaneous items in area adjacent or tributary to ditches 12-F to 12-G.

(a) Eliminate by the use of fill the extensive water pooling in area between taxiway and ditch 12-G for about 1200 feet below junction of 12-C-2 with 12-G. (IN).

(b) Install one-half round invert tile in road ditch in front of temporary barracks. (NFD).

\* Number illegible.



(c) Eliminate by the use of fill and/or one-half round invert tile the swampy area in the V between 12-G and 12-G-4. (IN).

(d) Install one-half round invert tile in ditch 12-G-5-A. (NFD).

(e) Install inlet box on barracks side of road and culvert to drain into upper end of 12-G-5-A. Install one-half round invert tile along both sides of highway in front of barracks. (IN).

(f) Regrade area in V between 12-G-4 and 12-G-4-A. (IN).

(g) Drain air raid trench located about 300 feet east of junction of 12-G-4-A and 12-G-4-A-1. (IN).

(h) Regrade area around temporary buildings at east end of air terminal area. (IN).

(k) Fill and regrade area on both sides of 12 from east end of air terminal area to a point about 450 feet above junction of 12-G and 12. Fill to within 3 feet of top of box culvert and install one-half round invert tile along each side of box culvert wall, with the tile discharging into box culvert through tide gates. Connect the 2 - 24" sewers and the 2 - 12" sewers now discharging into this swamp from the Panama Canal area into the box culvert by the use of sewers. (IN).

(23) Ditch 12-H. Clean and if this does not eliminate water pooling, regrade. (IN).

(24) Ditch 12-J. Regrade and complete installation of one-half round invert tile. (IN).

(25) Ditch 12-J-1. Clean and investigate possibility of steepening grade. (IN).

(26) Ditch 12-J-2. Install one-half round invert tile. (IN).

(27) Ditch 12-K. Complete junction with 12. (IN).

(28) Ditch 12-L. Eliminate potholes at junction with 12. (IN). Install one-half round invert tile to next 18" culvert. (LRD).

(29) Pave invert and side slopes from 12 to junction with 12-M. Install one-half round invert tile from latter point to junction with 12-M-4. Include short branch lateral and ditches into swampy area on west side of ditch. (IN). Install one-half round invert tile from junction with 12-M-4 to end. (LRD).

(30) Ditches 12-M-1, 12-M-2, 12-M-3, 12-M-4, 12-M-5 and 12-M-6. Install one-half round invert tile. (LRD). Regrade upper paved section of 12-M-3-A to eliminate pockets. (IN). Install one-half round invert tile in lower section of 12-M-3-A. (LRD).

(31) Ditch 12-N. Straighten, raise grade and pave invert to drain into 12. (IN).

(32) Ditch 12-P. Straighten, raise grade and pave invert to drain into 12. (IN).

(33) Ditches 12-P-1, 12-P-1-A and 12-P-1-B. Install one-half round invert tile. (IN).

(34) Ditch 12-P-2. Pave invert and side slopes from 12-P to next 30" culvert. (IN).

(35) Ditch 12-Q. Install one-half round invert tile from 12 to junction with 12-Q-1. (IN). Install one-half round invert tile in the remainder of this system. (LRD).

(36) Ditch 12-R. Install one-half round invert tile and regrade around ends of the two highway culverts at this point to eliminate pooling. (IN).

(37) Install one-half round invert tile in unpaved section of highway ditches on north side of Gaillard Highway between air terminal and motor transportation Division buildings. (LRD).

d. Miscellaneous Improvements.

(1) In all areas of Albrook Field and adjacent territory not specifically covered by items in the foregoing, landscaping is to be definitely completed, so that there will be left no permanent low areas, depressions, unfilled ditches (except air raid trenches), open pits around valve boxes and fire hydrants or deep ruts. (IN).

(2) Local low places which collect and hold water in Albrook Field proper between runways and taxiways will be eliminated by the use of fill and/or sub-drains. (IN).

(3) A house to house and building to building survey of all of Albrook Field and adjacent territory will be accomplished with special emphasis on one-half round invert tile roof drainage, the survey to insure that:

(a) The roof drainage system is entirely completed and carried to a point of definite disposal. If the discharge is to a stream, the end point will be so completed as not to cause potholes and erosion in the ditch slopes or inverts. If discharge is on the ground or hillside, a small area will be paved at the end of the tile. (IN).

(b) There will be no appreciable amount of water trapped in the drains. The drains will first be thoroughly cleaned and if, after cleaning, the water remains in any drain to a depth in excess of one-half inch, the drain will be regraded. (IN).

(4) Improve channel of the Curundu River west of the Panama Railroad culvert under Diabla Road. This improvement will consist of:

(a) Removing rocks and other debris and obstructions in the channel between the outlet of the twin box culverts and the railroad trestle furthestmost downstream. (IN).

(b) Removing the metal scrap and debris from the south slope of the drainage channel just below the trestles. (IN).

(c) Deepening the channel itself to obtain a definite outlet to the Canal. (IN).

(d) Removing fallen trees and any other serious obstructions between the twin culverts and the Canal. (IN).




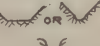

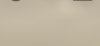






NOTE: Notations in circles thus (b8) refer to subdivisions of section 6 of accompanying report.

~ L E G E N D ~

-  — 1/2 ROUND INVERT TILE DITCH
-  — FULL CONCRETE DITCH
-  — DIRT DITCH
-  — CULVERT

SCALE: Approx V: 2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
ALBROOK, C. Z.

OFFICE OF THE DEPT. SURGEON  
RECOMMENDED Surge W Hamilton  
CAPT. SAN. CORPS  
APPROVED — COL. MED. CORPS

APPROVED  
ASST. CHIEF STAFF G-4  
DEPUTY DEPT. COMMANDER

AUGUST 1943

DRWG NO M.C. 4





NOTE: Notations in circles thus, (C) refer to subdivisions of section 6 of accompanying report



SCALE - Approx. 1:2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
ALBROCK, C. Z.

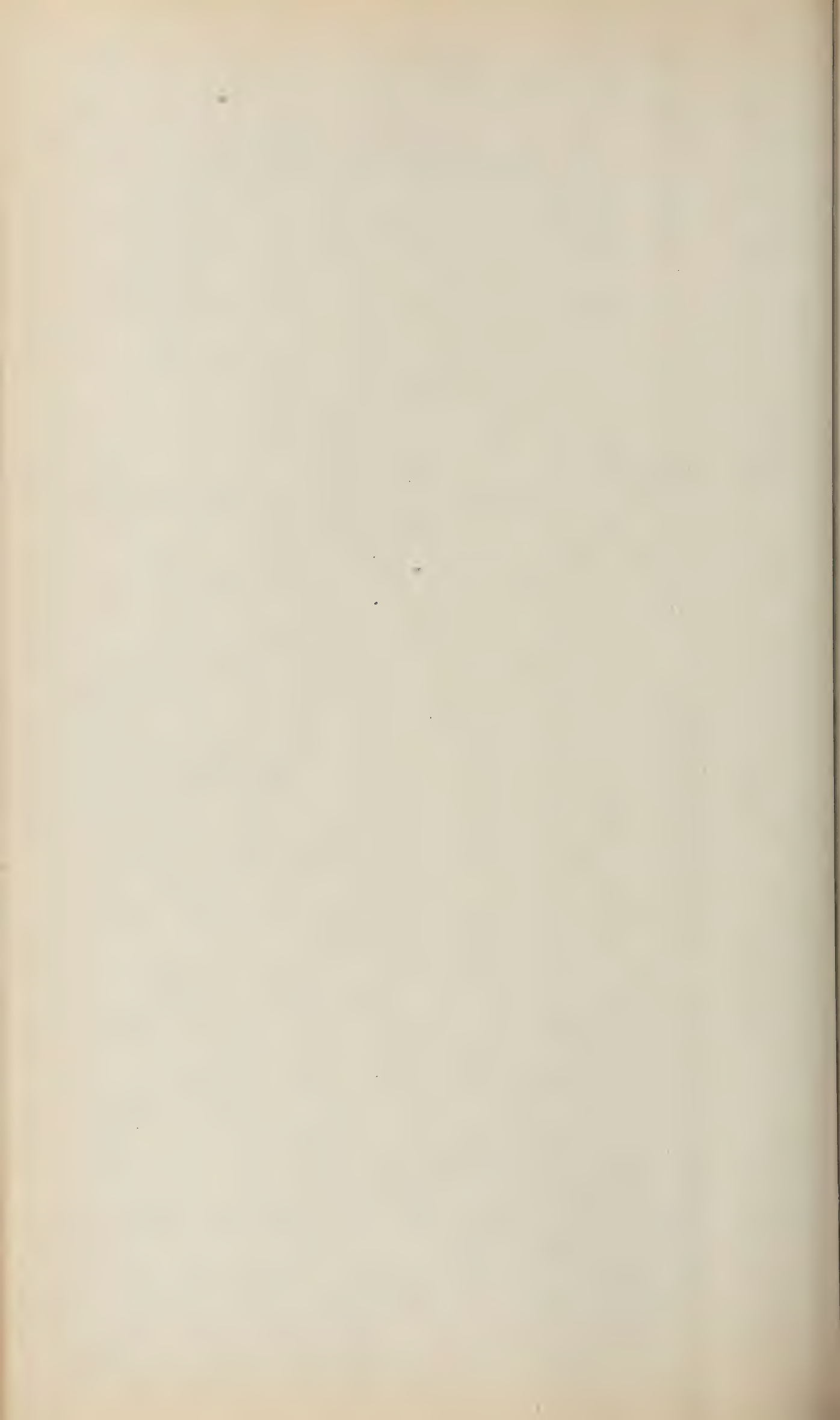
- LEGEND —
- 1/2 ROUND INVERT TILE DITCH
  - - - FULL CONCRETE DITCH
  - ... DIRT DITCH
  - on □ CULVERT

OFFICE OF THE DEPT. SURGEON  
RECOMMENDED *George W. Hambley*  
CAPT. SAN CORPS

APPROVED *COL. MED CORPS*

APPROVED *ASST. CHIEF STAFF G-4*  
DEPUTY DEPT. COMMANDER

AUGUST 1943 DRWG NO. MC-5


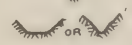

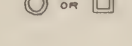






NOTE: Notations in circles thus (C6) refer to subdivisions of section 6 of accompanying report.

~ LEGEND ~

-  — 1/2 ROUND INVERT TILE DITCH
-  — FULL CONCRETE DITCH
-  — DIRT DITCH
-  — CULVERT

SCALE: Approx 1:2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
ALBROOK, C. Z.

OFFICE OF THE DEPT. SURGEON  
RECOMMENDER: *George W. Hamilton*  
CAPT. SAN CORPS ASST. CHIEF STAFF G-4  
APPROVED: *COL. MED CORPS* DEPUTY DEPT. COMMANDER

APPROVED

AUGUST 1943

DRWG NO M-C-6





MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

18 OCTOBER 1943





7. SPECIFIC REPORT ON FORT CLAYTON (AREA NO. 4).

a. Area included - Fort Clayton and vicinity as indicated by accompanying Maps M.C. 7 and M.C. 8.

b. Drainage System No. 13. Install one-half round invert tile from elevation 6.0 on main ditch to outlet of 24" culvert under highway. Include all laterals above elevation 6.0. (IN).

c. Drainage System No. 14. Install one-half round invert tile for this entire system from elevation 6.0 to the 24" culvert under the highway. (IN)

d. Drainage System No. 15.

(1) Ditch 15. Install one-half round invert tile from elevation 6.0 to a point 50 feet above 20" culvert under highway. Drain numerous pools and seepage areas on both sides of this ditch with one-half round invert tile. (IN).

(2) Ditch 15-A. Install one-half round invert tile. (LRD).

(3) Ditch 15-B. Install one-half round invert tile. (IN).

(4) Ditches 15-C, 15-D and 15-D-1. Combine insofar as practicable and install one-half round invert tile to end of water in each branch. (IN).

e. Drainage System No. 16.

(1) Ditch 16. In the section below junction with 16-A, repair holes in bottom of ditch; remove a temporary culvert which is pooling water and eliminate large water pools on each side of ditch by the use of fill and/or sub-soil drains. (IN).

(2) Ditch 16-A. Install one-half round invert tile from junction with 16 to next culvert. (LRD).

f. Drainage System No. 17. Install one-half round invert tile from elevation 6.0 to next 8" culvert. (IN).

g. Drainage System No. 18. Clean, repair and recondition this system, installing sub-soil drains in seepage areas at upper end. (IN).

h. Drainage System No. 19. Install one-half round invert tile from the Cardenas River to the upper end and install a culvert under the highway. Install sub-surface drains to dry up the seepage area southwest of the rock crusher. Connect waste water from crusher area into this system. (IN).

i. Drainage System No. 20.

(1) Ditch 20. Clean thoroughly and repair side walls. (IN).

(2) Ditch 20-A. Clean and repair side walls. (IN).

(3) Ditch 20-A-1. Install one-half round invert tile. (IN).

(4) Ditch 20-C. Recondition around outlet of 15" culvert. Divert upper section into inlet of 15" culvert to prevent water from running across highway and install one-half round invert tile from this point to upper end. (IN).

j. Drainage System No. 21. Install one-half round invert tile from \*.er to foot of slope with laterals to adjacent low areas. (IN).

k. Drainage System No. 22. Install one-half round invert tile from river to 30" culvert. (IN).

l. Drainage System No. 23. Install one-half round invert tile for entire system. (IN).

m. Drainage System No. 24. Install one-half round invert tile. (IRD).

n. Drainage System No. 25.

(1) Ditch 25. Repair and replace invert tile and pave side slopes from river to outlet of main culvert under highway. Repair end of culvert to eliminate pooling. (IN).

(2) Ditch 25-A. Clean and repair side walls. (IN).

(3) Ditch 25-B. Repair side walls. (IN).

(4) Ditch 25-B-1. Install one-half round invert tile. (IN).

o. Drainage System No. 26. Install one-half round invert tile. (IN).

p. Drainage System No. 27. Eliminate by the construction of a suitable drop connection, the large pothole at the intersection with the Cardenas River. (IN). Install one-half round invert tile in ditch 27. (NFD).

q. Drainage System No. 28.

(1) Ditch 28. Eliminate by the construction of a suitable drop connection the large pothole at the intersection with the Cardenas River. (IN).

\*\* Illegible



(2) Ditch 28-A. Install one-half round invert tile and install culvert under road to lumber yard. (IN).

(3) Ditch 28-B. Stabilize side slopes with sod or paving. (IN).

r. Drainage System No. 29.

(1) Ditch 29. Repair broken sections and wash-outs in side walls and thoroughly clean from Cardenas River to junction with 29-N. (IN). Pave side slopes from Cardenas River to junction with 29-K, replacing the 15" culvert immediately below junction with 29-F with culvert of adequate capacity. (LRD). Install one-half round invert tile from point of existing paving just above junction with 29-N to end of water in ditch. (LRD).

(2) Ditch 29-A. Install one-half round invert tile for 50 feet above junction with 29. (IN).

(3) Ditch 29-B. Repair side walls. (IN).

(4) Ditches 29-B-2 and 29-B-3. Install one-half round invert tile ...\* each for 50 feet above junction with 29-B. (IN).

(5) Ditch 29-C. Install one-half round invert tile from point of existing paving to end of water. (IN).

(6) Ditch 29-D. Straighten and pave invert and side slopes from junction with 29 to next 36" culvert. Pave side slopes for 400 feet above junction with 29-D-1. Install one-half round invert tile from this latter point to end of ditch. (IN).

(7) Ditch 29-F. Extend full length of valley and install one-half round invert tile. (IN).

(8) Ditch 29-G. Install one-half round invert tile from junction with 29 to 24" culvert. Replace 9" culvert under road. (IN).

(9) Ditches 29-G-1 and 29-G-2. Install one-half round invert tile.

(10) Ditch 29-H. Install one-half round invert tile. (IN).

(11) Ditches 29-J, 29-J-1 and 29-J-2. Install one-half round invert tile with subsurface drains to eliminate seepage area at upper end of 29-J-2. (IN).

(12) Ditch 29-K. Repair side walls. (IN).

(13) Ditch 29-K-1. Install one-half round invert tile. (IN).

\* Illegible



- (14) Ditch 29-L. Repair side walls. (IN).
- (15) Ditch 29-L-1. Install one-half round invert tile. (IN).
- (16) Ditch 29-M. Install one-half round invert tile. (IN).
- (17) Ditch 29-N. Regrade to eliminate pools of water. (IN).

s. Drainage System No. 30. Install one-half round invert tile from Cardenas River to 20" culvert. (IN).

t. Drainage System No. 31.

- (1) Ditch 31. Install one-half round invert tile. (IN).
- (2) Ditch 31-A. Install one-half round invert tile and install new culvert under road. Extend with one-half round invert tile to ditch 31. (NFD).
- (3) Ditches 31-B and 31-C. Install one-half round invert tile. (IN).
- (4) Ditch 31-D. Install one-half round invert tile. (NFD).

u. Drainage Systems Nos. 32, 33, 34, 35, 36, 37 and 39. Install one-half round invert tile. Include all tributaries. (Panama Canal property). (IN).

v. Drainage System No. 41.

- (1) Ditch 41.
- (a) Straighten and pave invert and side slopes from Rio Grande to culvert, under Panama Railroad. (Panama Canal property). (LRD).
- (b) Eliminate large erosion pool at outlet of culvert under Panama Railroad. (Panama Canal property). (NFD).
- (c) Finish paving invert and pave side slopes from junction with 41-F to junction with 41-G. (IN).
- (2) Ditch 41-A. Install one-half round invert tile. (Panama Canal property). (IN).
- (3) Ditch 41-B. Recondition culvert end at junction with 41-B-1. (IN). Pave side slopes above junction with 41-B-1. (NFD).

(4) Ditch 41-D-4. Install one-half round invert tile from inlet to 36" culvert at a point about 200 feet below junction with 41-D-5 to a point 200 feet above junction with 41-D-5. (IN).

(5) Ditch 41-D-1. Install one-half round invert tile. (NFD).

(6) Ditch 41-D-2. Pave invert and side slopes to a point about 300 feet below junction with 41-D-2-A. Install one-half round invert tile from this point to outlet of 24" culvert, together with sub-soil drain to seepage areas near this section. (IN).

(7) Ditch 41-D-2-A. Install one-half round invert tile. (IN).

(8) Ditch 41-D-4. Install one-half round invert tile from junction with 41-D-4-D to junction with 41-D-4-E. (IN). Remove and enlarge culvert located about 250 feet above junction with 41-D-4-A. (IN). Pave side slopes from junction with 41-D-4-A, to junction with 41-D-4-D. (LRD).

(9) Ditch 41-D-4-B. Install one-half round invert tile. (IN).

(10) Ditch 41-D-4-D. Pave side slopes from junction with 41-D-4 to next 18" culvert. Install one-half round invert tile above 18" culvert. (LRD).

w. Drainage System No. 42.

(1) Ditch 42.

(a) Straighten and pave invert and side slopes from Rio Grande to culvert under Panama Railroad. (Panama Canal property). (LRD).

(b) Recondition outlet of culvert under Panama Railroad. (Panama Canal property). (IN).

(c) Install one-half round invert tile from culvert inlet under detention dike to junction with 42-L. (IN).

(2) Ditch 42-A. Complete installing one-half round invert tile. (IN). (Panama Canal property).

(3) Ditch 42-B. Install one-half round invert tile. (NFD).

(4) Ditch 42-B-1. Straighten and install one-half round invert tile. (\*\*).

\*\*Illegible.

(5) Ditch 42-C. Install one-half round invert tile. (NFD).

(6) Ditch 42-D and 42-D-1. Install one-half round invert tile with sub-soil drains into major seepage areas. (NFD).

(7) Ditch 42-E. Stabilize both sideslopes and install sub-soil drains into major seepage areas. (IN).

(8) Ditch 42-E-1. Install one-half round invert tile with sub-soil drains into major seepage areas. (IN).

(9) Ditch 42-F. Install one-half round invert tile and pave side slopes. (IN).

(10) Ditch 42-G. Install one-half round invert tile including the several tributaries now pooling water. (IN).

(11) Ditch 42-H. Install one-half round invert tile for 100 feet above junction with 42. (IN).

(12) Ditch 42-J. Install one-half round invert tile. (IN).

(13) Ditch 42-K. Install one-half round invert tile for 200 feet above junction with 42.

x. Miscellaneous items in Clayton Area.

(1) Open the buried end of 24" culvert under river road about 150 feet from junction with Gaillard Highway. Extend dirt ditch to inlet of this culvert to drain an area about 100 feet east of inlet. (IN).

(2) Construct culvert under River Road at a point about 500 feet from intersection with Gaillard Highway. Extend with one-half round invert tile to \*.er (LRD)

(3) Drain or fill large hole in Clayton gardens about 450 feet northeast of end of ditch 23. (IN).

(4) Regrade borrow pit to drain and remove road ditch obstruction at a point along the north side of River Road about 200 feet from the bridge across the Cardenas River. (IN).

(5) Drain by the use of one-half round invert tile the swamp located about 100 feet southeast of ditch 25-A. (IN)

(6) Fill extensive and deep ruts in temporary road through north end of Clayton gardens. (IN).

(7) Fill extensive low areas now pooling water located in warehouse and lumber storage area located on the south side of hospital road about 450 feet northeast of junction of ditch 29 and 29-B. (IN).



(8) Fill low areas north of NCO quarters for Clayton Hospital. (IN).

(9) Drain by the use of one-half round invert tile the swamp located northeast of the end of ditch 31. (IN).

(10) Install one-half round invert tile along west side of road through the low cost housing area to drain into the 24" culvert in ditch 30. (IN).

(11) Drain by the use of one-half round invert tile the extensive swamp located northwest of ditch 29 about 400 feet down stream from junction of 29 and 29-B. (IN).

(12) Drain by the use of one-half round invert tile the swampy area located near the point at which ditch 29 emerges from the 15" culvert under the officers' quarters area. (IN).

(13) Regrade area around water tank to eliminate pooling of water. (IN).

(14) Regrade contractor's area located about 500 feet northwest of junction 41-D-4 and 41-D-4-B. (IN).

(15) Eliminate pooling around ends of 2' x 3' culvert in 41-D-4 at junction with 41-D-4-A. (IN).

(16) Fill low area now pooling water located about 350 feet west of junction of 41-D and 41-D-5. (IN).

(17) Complete filling and sodding of the Coast Artillery quadrangle to eliminate all water pooling. (IN).

(18) Connect in car wash drain for Infantry stable area with a pipe and install one-half round invert tile along toe of slopes to the Cardenas River. (IN).

(19) Construct splash plate under end of one-half round tile drain about 150 feet north of Gaillard Highway bridge over the Cardenas River. (IN).

(20) Clean and recondition end of ditch 38 between Rio Grande and first culvert. Regrade upper section of ditch 38 to eliminate pockets. Install one-half round invert tile in ditch 38-A. (IN) (Lower end of ditch 38 on Panama Canal property).

(21) Install one-half round invert tile in upper section of ditch 40 to drain into existing rock drain. (IN). (Panama Canal property).

(22) Drain by the use of one-half round invert tile the extensive water pooling between ditches 16 and 17. Fill around two sewer manholes in this same area. (IN).

(23) Fill around sewer manhole between ditches 21 and 22. (IN).

(24) Fill all ruts in temporary road along foot of slope paralleling Muir Ave. (IN).

(25) Fill extensive and deep ruts in the several roads to smoke pots and outpost positions in the area between ditch 42 and the new bridge across the Canal. (IN). (Panama Canal property).

(26) Drain by the use of one-half round invert tile extensive swamps for approximately 200 feet on both sides of ditch 29 from junction with 29-G to junction with 29-N. (LRD).

(27) Extend dirt ditch around upper side of barrage balloon area to drain into ditch 42-E-1. Install one-half round invert tile in entire system. (IN).

Y. Miscellaneous Improvements.

(1) In all the areas of Clayton, not specifically covered by items in the foregoing, landscaping is to be definitely completed so that there will remain no permanent low areas, depressions, unfilled ditches (except air raid trenches), open pits around valve boxes and fire hydrants or deep ruts. (IN).

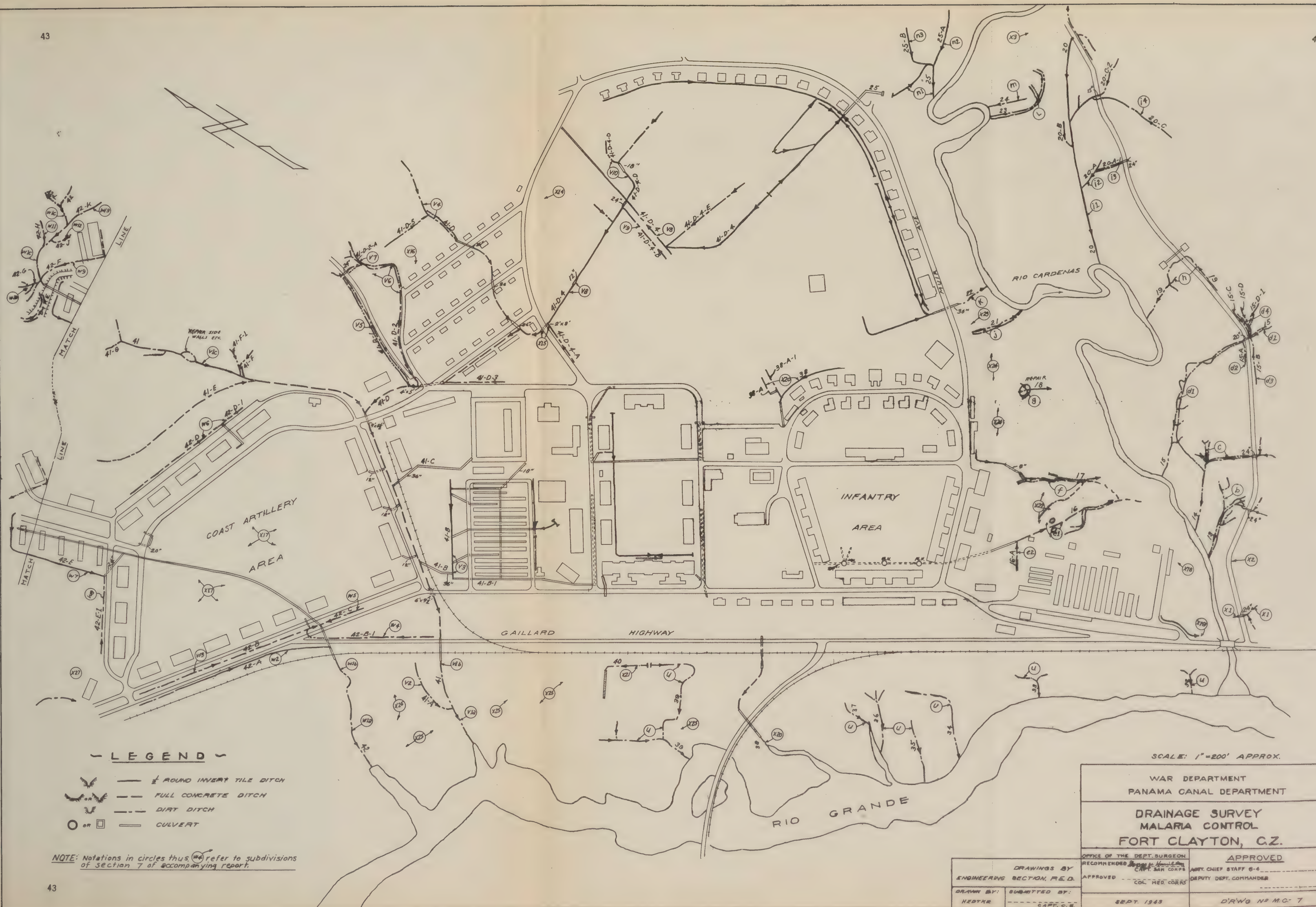
(2) A house to house and building to building survey is to be accomplished with special emphasis on one-half round invert tile roof drainage, the survey to insure that:

(a) The roof drainage system is entirely completed and carried to a point of definite disposal. If the disposal is to a stream, the end point is to be completed so as not to cause potholes or erosions in the ditch slopes or inverts. If discharge is on the ground or hillside, a small area is to be paved at the end of the tile.

(b) There will be no appreciable amount of water trapped in the drains. The drains will first be thoroughly cleaned and if after cleaning water remains in any drains in excess of one-half inch, the drain will be regraded. (IN).

(3) Straighten the Cardenas River at points opposite ditches 19 and 24, filling the old river channel and extending existing ditches to the new channel. (LRD).











~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

NOTE: Notations in circles thus (P2) refer to subdivisions of section 7 of accompanying report

SCALE: 1"=200' APPROX

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
FORT CLAYTON, C.Z.

DRAWINGS BY ENGINEERING SECTION, P.E.D.		APPROVED	
DRAWN BY Hedke		RECOMMENDED BY CAPT. SAN. CORPS	
SUBMITTED BY CAPT. C.E.		ASST CHIEF STAFF G-4 DEPUTY DEPT COMMANDER	
SEPT. 1943		D'RW'G NO M.C.- 8	





MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

19 OCTOBER 1943



8. SPECIFIC REPORT ON OUTLYING AREA (AREA NO. 5).

a. Area included. Territory on both sides of engine test road, Albrook-Clayton road, Corozal - Clayton road, Albrook magazine road and vicinities of dispersion warehouses and Clayton Hospital, all as shown on accompanying Map M.C. 9.

b. Drainage system No. 11. (Continued from Albrook Field Maps M.C. 4, M.C. 5 and M.C. 6.).

(1) Ditch 11-G. Straighten and pave invert and side slopes from junction with 11-G-12. to end. Install one-half round invert tile in all tributaries above 1-G-16. (LRD) Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(2) Ditches 11-G-13, 11-G-14, 11-G-15, 11-G-16 and 11-G-16-A. Install one-half round invert tile. (IN).

(3) Ditch 11-L. Straighten and pave invert and side slopes from Junction with 11-L-11 to junction with 11-L-12. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN). Pave invert from junction with 11-L-12 to a point 50 feet upstream from Albrook magazine road and from a point 100 feet below the 6' x 5' culvert under Albrook-Clayton Highway to a point 100 feet above junction with 11-L-14. (IN). Pave remainder of invert from junction with 11-L-12 to end and pave the side slopes of this entire section. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN)

(4) Ditches 11-L-12 and 11-L-12-A. Install one-half round invert tile. (IN).

(5) Ditch 11-L-13. Install one-half round invert tile from junction with 11-L to a point 100 feet above junction with 11-L-13-A. (IN).

(6) Ditch 11-L-13-A. Install one-half round invert tile for 50 feet above junction with 11-L-13. (IN).

(7) Ditch 11-L-14. Straighten and install one-half round invert tile from junction with 11-L to a point 100 feet above junction with 11-L-14-D. (IN).

(8) Ditches 11-L-14-C and 11-L-14-D. Install one-half round invert tile. (IN).

(9) Ditch 11-Z. Install one-half round invert tile from 24" culvert under highway and about 300 feet above junction with 11-Z-9 to junction with 11-Z-11. (NFD) Above this point stream is well shaded but is characterized by extensive pooling.



Install one-half round invert tile from junction with 11-Z-11 to end of water. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(10) Ditch 11-Z-9. Install one-half round invert tile for 100 feet above <sup>\*\*</sup> culvert under Albrook-Clayton Road. (NFD). Above this point, stream is well shaded but has pooling characteristics. Install one-half round invert from the 100 foot point to end of water. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(11) Ditch 11-Z-10. Install one-half round invert tile for 50 feet above <sup>\*\*</sup> culvert under Albrook -Clayton Road. (NFD).

c. Drainage system No. 12. (Continued from Albrook Map M.C. 5).

(1) Ditch 12-C. Pave invert and side slopes from 36" culvert near junction with 12-G-8 to a point 200 feet above junction with 12-G-17. (NFD). Install one-half round invert tile from this latter 200 foot point to end of line. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(2) Ditch 12-G-8. Install one-half round invert tile from junction with 12-G to 20 feet above 20" culvert. (IN).

(3) Ditch 12-G-9. Install one-half round invert tile from junction with 12-G to end. Remove temporary 10" culvert and reset 24" culvert under highway at junction with 12-G-9-A, if this is necessary to eliminate trapped water in culvert. (IN).

(4) Ditch 12-G-9-A. Install one-half round invert tile. (IN).

(5) Ditches 12-G-10, 12-G-11, 12-G-12, 12-G-13, 12-G-13-A and 12-G-14. Install one-half round invert tile. (IN).

(6) Ditch 12-G-15. Fill, connecting the 20" culvert under engine <sup>\*</sup>estrroad into ditch 12<sup>\*\*</sup> with one-half round invert tile. (IN).

(7) Ditch 12-G-16. Install one-half round invert tile from junction with 12-G to next 20" culvert. Regrade ditch above 20" culvert to eliminate pooling at upper end. (IN).

(8) Ditch 12-G-17. Install one-half round invert tile from junction with 12-G to next 20" culvert. (IN).

(9) Ditch 12-G-4. Pave invert and side slopes from the two 36" culverts just below junction with 12-G-4-C to a point 100 feet above junction with 12-G-4-K. (NFD) Pave invert and side slopes from this latter point to a point \*\*00 feet below junction with 12-G-4-N. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN). From the point 100 feet below junction with 12-G-4-N, install one-half round invert tile to a point \*\*.00 feet above junction with 12-G-4-Q. (IN). From this latter point install one-half round invert tile to end of system. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(10) Ditches 12-G-4-C, 12-G-4-C-1, 12-G-4-D, 12-G-4-D-1, and 12-G-4-D-2. Install one-half round invert tile. (IN).

(11) Ditch 12-G-4-E. Straighten and install one-half round invert tile. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(12) Ditch 12-G-4-F. Install one-half round invert tile from junction with 12-G-4 to 200 feet above junction with 12-G-4-F-2. (IN).

(13) Ditches 12-G-4-F-1, 12-G-4-F-1-A and 12-G-4-F-1-B. Install one-half round invert tile. (IN).

(14) Ditch 12-G-4-F-2. Install one-half round tile from junction with 12-G-4 to 200 feet above this junction. (IN).

(15) Ditch 12-G-4-F-2-A. Install one-half round invert tile from junction with 12-G-4-F-2 to 50 feet above this junction. (IN).

(16) Ditch 12-G-4-G. Install one-half round invert tile from junction with 12-G-4 to a point 100 feet past east wall of dispersion warehouse, projected. Fill all holes in ditch above this point. (IN).

(17) Ditch 12-G-4-H. Install one-half round invert tile. (IN).

(18) Ditch 12-G-4-J. Install one-half round invert tile. (IN).

(19) Ditch 12-G-4-J-1. Install one-half round invert tile. (IN)

(20) Ditch 12-G-4-J-2. Install one-half round invert tile from junction with 12-G-4-j to 24" culvert. Pave around inlet to 24" culvert. (IN).



(21) Ditches 12-G-4-K and 12-G-4-L. Install one-half round invert tile. (IN).

(22) Ditch 12-G-4-M. Install one-half round invert tile. (LRD.) Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(23) Ditches 12-G-4-N, 12-G-4-N-1 and 12-G-4-N-2. Install one-half round invert tile, filling low areas adjacent to these ditches. (IN).

(24) Ditch 12-G-4-N-3. Regrade. (IN).

(25) Ditch 12-G-4-O. Install one-half round invert tile. (IN).

(26) Ditches 12-G-4-P and 12-G-4-P-1. Regrade to eliminate pooling of water. (IN).

(27) Ditch 12-G-4-Q Install one-half round invert tile from junction with 12-G-4 to a point 450 feet above this junction. (IN). Install one-half round invert tile from this latter point to end of ditch. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

d. Miscellaneous items in areas tributary to Drainage Systems 11 and 12.

(1) Fill all ruts, depressions, unfilled valve boxes, etc., along the entire Albrook magazine road. Regrade road ditches at points where they are retaining water. Eliminate by the use of one-half round invert tile and sub-soil drains the seepage area along this road at a point south of the Las Cruces supply storage yard. (IN).

(2) Fill extensive and deep ruts in road loop northwest of 6' x 6' box culvert under Clayton - Albrook Highway in ditch 11-G. (IN).

(3) Drain swamp located 50 feet east of intersection of ditches 11-L and 11-L-12 into 11-L. (IN).

(4) Regrade area at Albrook Gun Club between ditches 12-G-10 and 12-G-12. (IN).

(5) Eliminate extensive pooling of water along east side of ditch 12-G-9 from junction with 12-G-9-A to end by the use of fill and one-half round invert tile. (IN).

(6) Eliminate by the use of fill and one-half round invert tile the swampy area located about 150 feet north-east of Albrook Gun Club Clubhouse. (IN).



(7) Fill the low area between ditches 12-G and 12-G-14 to drain into these ditches. (IN).

(8) Install one-half round invert tile system and culvert under highway for the area northeast of the Tucker McClure barracks area in general accordance with layout indicated on Map M.C. 9. (IN).

(9) Eliminate by the use of fill and one-half round invert tile the swampy area in the V between ditches 12-G-4-C and 12-G-4-C-1. (IN).

(10) Eliminate by the use of one-half round invert tile and sub-soil drains the seepage areas along the west side of ditch 12-G-4-F-1. (IN).

(11) Eliminate by the use of one-half round invert tile and fill the swampy area between ditch 12-G-4-F and the dispersion warehouse road. (IN).

(12) Fill ruts, trenches and holes in area between ditch 12-G-4 and dispersion warehouse road. (IN).

(13) Fill old ditch channel in V between ditches 12-G-4 and 12-G-4-H. (IN).

(14) Fill ruts and depressions in dumping area southeast of ditch 12-G-4-J-2. (IN).

(15) Eliminate by the use of one-half round invert tile and fill the extensive swamp located about 100 feet north of the end of ditch 12-G-4-L. (IN).

(16) Eliminate the extensive swampy area located about 100 feet east of the engine test plant by regrading it to drain into ditches 12-G-4 and 12-G-4-O. (IN).

(17) Fill or drain large hole at southwest corner of engine test plant office building. (IN).

(18) Repair leaky fire hydrant in engine test plant area. (IN).

(19) Fill large holes located about 100 feet and 200 feet respectively west of the engine test plant office. (IN).

a. Drainage system No. 43.

(1) Straighten and install one-half round invert tile in this entire system from the Cardenas River to the two 12" culverts and the three 24" culverts. (IN). Install one-half round invert tile above the three 24" culverts. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

f. Drainage system No. 25.

(1) Ditch 25-A. Install one-half round invert tile. (LRD).

(2) Ditch 25-A-1 Clean and repair. (IN).

g. Drainage system No. 45.

(1) Ditch 45. Straighten and pave invert and side slopes from a point 100 feet below junction with 45-D to a point 100 feet above junction with 45-G. Straighten and pave invert and side slopes from a point 100 feet below junction with 45-J to a point 50 feet beyond fence around gasoline reserve storage area and about 100 feet above junction with 45-T. Areas adjacent to sides of ditch to be filled and graded as required to accomplish complete drainage for the area. All of above (IN). Straighten and pave invert and side slopes of remainder of ditch from Cardenas River to end. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(2) Ditch 45-A. Install one-half round invert tile for 100 feet below and above 24" culvert located about 400 feet above junction with 45. (IN). Install one-half round invert tile in remainder of this ditch. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(3) Ditch 45-A-1. Install one-half round invert tile. (IN).

(4) Ditch 45-A-2. Install one-half round invert tile for 30 feet above junction with 45-A. (IN).

(5) Ditch 45-B. Install one-half round invert tile from junction with 45 to end. (IN).

(6) Ditch 45-B-1. Install one-half round invert tile. (LRD).

(7) Ditch 45-C. Drain and fill this ditch which is the old stream channel. By deepening ditch 45 from junction with 45-B to junction with 45-D, almost total drainage of 45-C can be accomplished requiring a minimum of filling to eliminate this extensive pool. (IN).

(8) Ditch 45-D. Install one-half round invert tile. (IN).

\*\* Figure illegible



(9) Ditch 45-E. Install one-half round invert tile for 100 feet above junction with 45. (IN) Install one-half round invert tile in remainder of ditch. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(10) Ditch 45-F. Pave invert and side slopes from junction with 45 to junction with 45-F-9. Install one-half round invert tile above this point. (IN).

(11) Ditches 45-F-1, 45-F-2, 45-F-3, 45-F-4, 45-F-5, 45-F-7, 45-F-8, 45-F-9 and 45-F-10. Install one-half round invert tile in all of these ditches including all the branch laterals to them. (IN).

(12) Ditch 45-F-6. Install one-half round invert tile for 200 feet above junction with 45-F. (LRD).

(13) Ditch 45-G. Replace with sub-soil drain. (IN).

(14) Ditch 45-H. Install one-half round invert tile from junction with 45 to 200 feet above junction with 45-H-4. (IN). Install one-half round invert tile from this latter point to end. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(15) Ditch 45-H-1. Install one-half round invert tile from junction with 45-H to 350 feet above junction with 45-H-1-A. (IN).

(16) Ditches 45-H-1-A and 45-H-1-B. Install one-half round invert tile for 100 feet above junction with 45-H-1. (IN).

(17) Ditch 45-H-2. Install one-half round invert tile from junction with 45-H to 20 feet above 24" culvert under Clayton-Albrook Highway. (IN).

(18) Ditch 45-H-3. Install one-half round invert tile including the tributary road ditch system on the north side of Los Cruces supply storage yard. (IN).

(19) Ditch 45-H-4. Install one-half round invert tile from junction with 45-H to 30 feet above next culvert. (IN).

(20) Ditch 45-J. Install one-half round invert tile with laterals as required to drain completely the extensive swamp at the upper end of this system. (IN).



(21) Ditch 45-K. Straighten and pave invert and side slopes from junction with 45 to 100 feet above 12" culvert across trail. Replace the 12" culvert with a culvert of adequate capacity or remove entirely if this trail is to be abandoned. (IN). Install one-half round invert tile from this point to end of system. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

(22) Ditch 45-L. Straighten and install one-half round invert tile. Remove 6" and 12" temporary culverts and fill area on both sides of ditch to drain to it. (IN).

(23) Ditches 45-M, 45-M-1, 45-N and 45-N-1. Straighten and install one-half round invert tile. (IN).

(24) Ditch 45-O. Straighten, fill and install one-half round invert tile. (IN).

(25) Ditches 45-P, 45-Q and 45-R. Combine insofar as practicable and install one-half round invert tile. (IN).

(26) Ditch 45-S. Install one-half round invert tile to 50 feet beyond fence enclosure. (IN). Install one-half round invert tile for remainder of system. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. (IN).

h. Drainage system No. 44.

(1) Ditch 44. Install one-half round invert tile. (LRD).

i. Drainage system No. 46.

(1) Install one-half round invert tile in entire system. (IN).

j. Drainage system No. 47.

(1) Ditch 47. Pave invert and side slopes from Cardenas River to junction with 47-A. (LRD). Improve the flow characteristics of this last mentioned section by simple regrading and removing various obstructions from channels. Avoid the destruction of shade. Pave invert and side slopes from junction with 47-A to junction with 47-D. (NFD). Install one-half round invert tile in the remainder of ditch 47 and all of its tributaries. (IN).

k. Drainage system No. 48.

(1) Install one-half round invert tile in this entire system. (IN).

1. Drainage system No. 49.

(1) Install one-half round invert tile with laterals as required to completely drain the adjacent area. (IN).

m. Drainage system No. 10.

(1) Ditch 10-K. Install one-half round invert tile for 100 feet below 24" culvert and for 50 feet above it. (IN).

(2) Ditch 10-K-1. Install one-half round invert tile for 100 feet above 24" culvert. (IN).

n. Miscellaneous items in area tributary to drainage systems 44 to 49 inclusive.

(1) Fill extensive ruts in road over 16" culvert in ditch 43. (IN).

(2) Fill around sanitary sewer manhole and complete backfilling of trench at foot of highway; fill slope about 200 feet north of end of ditch 46. (IN).

(3) Fill large hole now impounding water at a point about 100 feet north of end of ditch 46-L. (IN).

(4) Complete backfilling trench along trail located generally along line between intersections of ditches 45 with 45-F and 45 with 45-J. (IN)

(5) Complete landscaping the gasoline reserve area so that it will rain into the system of paved ditches proposed under preceding paragraphs so that there will be left no ruts, holes, depressions, etc. to retain water. (IN).

(6) Fill ruts in trail leading from Albrook - Clayton Highway to 12" culvert in ditch 45-K. (IN).

(7) Eliminate swampy and seepage areas along west side of Clayton-Albrook Highway between ditches 45-H-1 and 45-H by the use of fill and one-half round invert tile. (IN).

(8) Completely recondition the shoulders and side ditches of the Clayton -Albrook Highway between Clayton Hospital and the concrete batching plant at Albrook Field so that no water is retained by them. (IN).





NOTE: Notations in circles thus (C4) refer to subdivisions of section B of accompanying report.



— LEGEND —

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

SCALE: Approx 1:5000

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
OUTLYING AREA ALONG  
ALBROOK-CLAYTON HIWAY

OFFICE OF THE DEPT. SURGEON RECOMMENDED: DRAWINGS BY ENGINEERING SECTION, R.E.D.		APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER	
DRAWN BY: H. G. H. K.		SUBMITTED BY: CAPT. C. E.	
AUGUST 1943		DR'WG NO MC-9	



CONTINUATION OF  
MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

2 NOVEMBER 1943.





9. SPECIFIC REPORT ON FORT KOBBE AND HOWARD FIELD  
(AREA NO. 6).

a. Area included - Fort Kobbe, Howard Field and vicinity as indicated by accompanying Maps M.C. 10, M.C. 11, M.C. 12 and M.C. 13.

b. Drainage system No. 50.

(1) Ditch 50.

(a) Deepen and improve channel downstream from junction with 50-A until well defined flow is maintained at low tide. (LRD).

(b) Pave invert and side slopes from junction with 50-A to the three 30" culverts near junction with 50-E. (LRD).

(c) Pave invert and side slopes from the last mentioned three 30" culverts to junction with 50-K. (IN).

(d) Install one-half round invert tile from junction with 50-K to the 4' x 4' culvert near junction with 50-Q. Clean and repair from junction with 50-Q to junction with 50-Z and install one-half round invert tile from junction with 50-Z to end of system. (IN).

(2) Ditch 50-A. Pave invert and side slopes. (LRD).

(3) Ditch 50-B.

(a) Pave invert and side slopes from junction with 50 to junction with 50-B-1. (LRD).

(b) Pave invert and side slopes from junction with 50-B-1 to junction with 50-B-10. (IN).

(c) Install one-half round invert tile from junction with 50-B-10 to end of system. (IN).

(4) Ditches 50-B-1 to 50-B-10 inclusive.  
Regrade and install one-half round invert tile in all of these ditches, including the tributaries indicated. Completely recondition the drainage system for the revetment area between the hangers and the east side of the north and south runway. At the present this area is characterized by low spots and ditches impounding water, together with numerous ruts. To eliminate this hazardous condition, regrade individual revetment ditches, installing one-half round invert tile in those that are continually fed by ground water seepage and fill the low areas and ruts until the whole area becomes a dry and adequately drained locality. (IN)

(5) Ditch 50-C. Pave invert and side slopes from junction with 50 to the beginning of the existing paved section near Howard Avenue. (LRD). Install one-half round invert tile from 24" culvert at Howard Ave. to end of system. (IN).

(6) Ditch 50-C-1. Pave invert and side slopes from junction with 50-C to junction with 50-C-1-A. (LRD). Pave invert and side slopes from junction with 50-C-1-A to the 30" culvert about 300 feet above junction with 50-C-1-C. (IN). Complete roof drainage system at upper end. (IN).

(7) Ditches 50-C-1-A, 50-C-1-B and 50-C-1-C. Install one-half round invert tile, including the tributaries indicated. (IN).

(8) Ditch 50-C-2. Install one-half round invert tile from junction with 50-C to 12" culvert under Howard Ave. (IN).

(9) Ditch 50-C-3. Install one-half round invert tile including the indicated tributary. (IN).

(10) Ditch 50-C-4. Install one-half round invert tile. (IN).

(11) Ditch 50-C-5. Install one-half round invert tile. (IN).

(12) Ditch 50-D. Pave invert and side slopes from junction with 50 to junction with 50-D-1. Install one-half round invert tile from this latter point to the 12" culvert at junction with 50-D-3. (IN).

(13) Ditch 50-D-1. Install one-half round invert tile. Include tributaries and new laterals as required to drain the swampy area at the upper end of this system. (IN).

(14) Ditch 50-D-2. Dig new channel from lower end of 50-D-2 which now terminates in a swamp to junction of 50-D with 50. Install one-half round invert tile from this latter point to 20 feet above 24" culvert under Howard Ave. Regrade 50-D-2 above this point to end of system. (IN).

(15) Ditch 50-D-2-A. Install one-half round invert tile. (IN).

(16) Ditch 50-D-2-B. Install one-half round inverted tile. (LRD).

(17) Ditch 50-D-2-C. Regrade. (IN).

(18) Ditch 50-E. Pave invert and side slopes and/or install concrete storm sewer from the junction with 50 to the existing storm sewer near junction with 50-E-3. (IN).



(19) Ditch 50-E-1. Install one-half round invert tile from junction with 50-E to 20 feet above junction with 50-E-1-A. (IN).

(20) Ditch 50-E-1-A. Install one-half round invert tile from junction with 50-E-1 to junction with 50-E-1-A-1. (IN).

(21) Ditch 50-E-2. Install one-half round invert tile from junction with 50-E to end. (IN).

(22) Ditch 50-E-2-A. Install one-half round invert tile from junction with 50-E-2 to end connecting in car washing rack at end. (IN).

(23) Ditch 50-E-2-B. Install one-half round invert tile. (LRD).

(24) Ditches 50-F, 50-G, 50-H and 50-J. Install one-half round invert tile. (IN).

(25) Ditch 50-K. Install one-half round invert tile from junction with 50 to junction with 50-K-10, including culvert under street. Divert into 50-E at junction with 50-K-7. (IN). Install one-half round invert tile from junction with 50-K-10 to end of system. (LRD).

(26) Ditches 50-K-1 and 50-K-2. Install one-half round invert tile. (IN).

(27) Ditch 50-K-3. Install one-half round invert tile. Include culvert under street with fill and laterals as required to eliminate the pooling of water at the upper end. Install one-half round invert tile in the loop and tributaries. (IN).

(28) Ditches 50-K-4 and 50-K-5. Install one-half round invert tile. Eliminate water pooling in abandoned obstacle course area near ends of these ditches. (IN).

(29) Ditches 50-K-6, 50-K-6-A and 50-K-6-A-1. Install one-half round invert tile with new culvert under road. (IN).

(30) Ditch 50-K-7. Install one-half round invert tile for 50 feet above junction with 50-K. (IN).

(31) Ditches 50-K-8 and 50-K-9. Install one-half round invert tile with laterals and fill as required to dry up seepage areas at upper ends. (IN).

(32) Ditch 50-L. Install one-half round invert tile. (IN).

(33) Ditch 50-M. Install one-half round invert tile in sections now unpaved from junction with 50 to 20 feet above junction with 50-M-8. Clean entrance to culvert at junction with 50-M-7. (IN).

(34) Ditch 50-M-1. Regrade. (IN).

(35) Ditch 50-M-2. Install one-half round invert tile for 110 feet above junction with 50-M.

(36) Ditches 50-M-3, 50-M-4, 50-M-5, 50-M-6 and 50-M-8. Install one-half round invert tile extending 50-M-8 to drain low area at its upper end. (IN).

(37) Ditch 50-N. Install one-half round invert tile from junction with 50 to 50 feet above junction 50-N-2. Include ditch 50-N-1. (IN).

(38) Ditch 50-P. Install one-half round invert tile for 20 feet above junction with 50. (IN).

(39) Ditch 50-Q. Install one-half round invert tile. (IN).

(40) Ditch 50-Q-1. Install one-half round invert tile. (LRD).

(41) Ditches 50-R and tributaries. Install one-half round invert tile in this entire system. Extend 50-R-3 with laterals and fill as required to eliminate pooling near upper end of this ditch. (IN).

(42) Ditch 50-T. Regrade. (IN).

(43) Ditches 50-W and 50-Y. Install one-half round invert tile. (IN).

(44) Ditch 50-Z. Install one-half round invert tile from junction with 50 to within 100 feet of upper end. (IN).

(45) Ditch 50-X. Cut new channel from junction of 50-C with 50 to lower end of 50-K. Install one-half round invert tile from junction with 50 to end. Include ditch 50-X-2. (IN).

(46) Ditch 50-X-1. Clean several uprooted trees from across this channel. (IN).

c. Miscellaneous items in area tributary to drainage system No. 50.

(1) Fill, regrade and install one-half round invert tile as required to eliminate extensive pooling of water in contractor's area about 500 feet east of operations hangar. (IN).

(2) Fill, regrade and install one-half round invert tile as required to eliminate extensive pooling of water in area about 200 feet east of the base signal warehouse and install adequate roof drainage system for this building. (IN).



(3) Install one-half round invert tile around foot of cut for barracks located about 300 feet southeast of Ditch 50-C. Regrade and fill ruts around these barracks. (IN)

(4) Fill and install one-half round invert tile to eliminate swampy area located about 200 feet southeast of end of ditch 50-C-5. Drain into 50-C-5 or 50-E. (IN)

(5) Fill large hole about 200 feet east of junction of 50-C-1-D and 50-C. (IN).

(6) Complete grading around sewage treatment plant. (IN).

(7) Cover open manhole about 100 feet west of junction of 50-X and 50-X-1. (IN).

(8) In the low cost housing area, fill the numerous holes left by incompleted construction activities, ruts, low areas and holes around concrete piers. Drain air raid trenches located near end of ditch B-24. (IN).

(9) Fill holes in area between 50-P and 50-R-1. (IN).

(10) Fill low area about 200 feet northwest of end of ditch 50-M-2. (IN).

(11) Fill holes, ruts and low areas in area between 50-D and 50-D-2. (IN).

(12) Recondition inlet to 12" culvert in 50-D-3 under Howard Ave. and regrade around building used as boxing areas. (IN).

(13) Repair valve in water system near end of 50-D-2-B. (IN).

(14) Fill hole near end of 2 -30" culverts in ditch 50-E under Howard Ave. (IN).

(15) Install new one-half round invert tile to drain area located about 100 feet north of junction of 50-K and 50-K-7. (IN).

(16) Fill holes located 600 feet south of junction of 50-C and 50-C-4 and 450 feet southwest of this same junction. (IN).

(17) Regrade around officers' quarters, buildings located 400 feet southeast of junction of 50-K and 50-K-10 and 600 feet northeast of this same junction. (IN).



d. Drainage system No. 51.

(1) Ditch 51.

(a) Pave invert and side slopes from a point 1300 feet downstream from junction with 51-A to the 2 - 30" culverts about 100 feet downstream from junction with 51-L. (LRD) Improve flow characteristics of this section by simple regrading and removal of obstructions from channel. Avoid the destruction of shade. (IN).

(b) Install one-half round invert tile from the last mentioned 2 - 30" culverts to end of system. (IN).

(2) Ditch 51-A. Pave invert and side slopes. Fill old channel which crosses this ditch about 200 feet above junction with 51. (IN).

(3) Ditches 51-B, 51-C and 51-D. Install one-half round invert tile including the several tributaries indicated. Ditches 51-C and 51-D are old ditch channels cut off from their normal water sheds by a diversion ditch and are practically stagnant with large numbers of pools. (IN).

(4) Ditches 51-E, 51-G, 51-L and 51-M. See subsequent report for recommendations for these ditches.

(5) Ditch 51-N. Install one-half round invert tile. Include tributaries and extend as required together with necessary fill to eliminate pooling of water near end of 18" culvert. (IN).

(6) Ditches 51-P, 51-Q and 51-R. Install one-half round invert tile, including tributary indicated. (IN).

(7) Ditch 51-F. Pave invert and side slopes from junction with 51 to a point 100 feet above junction with 51-F-8.

(8) Ditch 51-F-4. Pave invert and side slopes from junction with 51-F to junction with 51-F-4-D. Install one-half round invert tile for 600 feet above this latter point. (LRD).

(9) Ditch 51-F-4-A. Regrade, fill around and install one-half round invert tile to completely drain the area adjacent to this ditch. (IN).

(10) Ditches 51-F-4-B, 51-F-4-C and 51-F-4-D. Install one-half round invert tile. (IN).

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(11) Ditch 51-F-5. Install one-half round invert tile from junction with 51-F to a point about 100 feet above the 12 inch culvert located about 200 feet above junction with 51-F-5-G. Straighten, regrade and fill as required to completely drain this system which at present is totally trapped at one point and is little more than a series of large, stagnant pools of water from junction with 51-F-5-E to the 12" culvert previously mentioned. (IN).

(12) Ditch 51-F-5-A. Install one-half round invert tile with laterals as required to drain swampy area at upper end. (IN).

(13) Ditch 51-F-5-B. Install one-half round invert tile. (IN).

(14) Ditch 51-F-5-C. Install one-half round invert tile for 110 feet above junction with 51-F-5. (IN).

(15) Ditches 51-F-5-D and 51-F-5-D-1. Install one-half round invert tile. (IN).

(16) Ditch 51-F-5-D-2. Install one-half round invert tile with laterals and fill as required to dry up swampy area at upper end. (IN).

(17) Ditch 51-F-5-D-3. Install one-half round invert tile for 100 feet above junction with 51-F-5-D. (IN).

(18) Ditches 51-F-5-E, 51-F-5-F and 51-F-5-G. Install one-half round invert tile. (IN).

(19) Ditch 51-F-6. Install one-half round invert tile. Include tributaries indicated with laterals as required to dry up swampy area at upper end. (IN).

(20) Ditch 51-F-7. Install one-half round invert tile from junction with 51-F to the outlet of the 12" culvert located about 200 feet above junction with 51-F-7-G. (IN).

(21) Ditch 51-F-7-A. Install one-half round invert tile for 50 feet above junction with 51-F-7. (IN).

(22) Ditch 51-F-7-B. Install one-half round invert tile from junction with 51-F-7 to end of system. Eliminate the loop indicated, with fill. (IN).

(23) Ditches 51-F-7-B-1, 51-F-7-B-2 and 51-F-7-B-3. Install one-half round invert tile. (IN).

(24) Ditch 51-F-7-C. Install one-half round invert tile in the section between the first 2 - 12" culverts in the system. (IN).

(25) Ditch 51-F-7-D. Install one-half round invert tile and include the several tributaries indicated. (IN).

(26) Ditch 51-F-7-E. Install one-half round invert tile and include the several tributaries indicated. (IN).

(27) Ditch 51-F-7-F. Install one-half round invert tile. (IN).

(28) Ditch 51-F-7-G. Install one-half round invert tile and include the tributary indicated. (IN).

(29) Ditches 51-F-7-H and 51-F-7-J. Install one-half round invert tile for 20 feet above junctions with 51-F-7. (IN).

(30) Ditch 51-F-8. Install one-half round invert tile. (IN).

(31) Ditch 51-H. Install one-half round invert tile with laterals as required to dry up swampy area near junction with 51-H-1. (IN).

(32) Ditches 51-H-1, 51-J and 51-K and tributaries. Regrade as required to eliminate local pooling of water. (IN).

e. Miscellaneous items in area tributary to drainage system No. 51.

(1) Eliminate numerous pools of water along banks of ditch 51 from point 1300 feet below junction with 51-A to junction with 51-F. Simple regrading will suffice. (IN).

(2) Fill and/or drain area bounded generally by the west side of the north and south runway and ditch 51-F between junctions with 51-F-4 and 51-F-8. At the present time, this area is a veritable mass of impounded water consisting of swamps, uprooted tree holes, old ditch channels whose normal water-sheds have been diverted, deep and extensive ruts and low areas trapped by excavation. (IN).

(3) Regrade area located along projection of south end of the west side of the north and south runway. (IN).

(4) Fill and/or drain extensive swampy area in V between ditches 51-C-2 and 51-C-2-A. (IN).



f. Drainage system No. 52.

(1) Ditch 52.

(a) See subsequent report for recommendations below road culvert located about 400 feet below junction with 52-A.

(b) Improve channel by simple regrading and removal of obstructions from last mentioned culvert to beginning of existing paved section. (IN). Install one-half round invert tile in this same section. (LRD).

(c) Clean section above junction with 52-B and regrade if this does not eliminate the pooling of water. (IN).

(d) Eliminate a seepage area located about 150 feet below junction with 52-B by the use of a sub-soil drain. (IN).

(2) Ditches 52-A and 52-B. Install one-half round invert tile. (LRD).

(3) Ditch 52-E. Regrade 12" culvert under railroad at lower end of this ditch to permit total drainage. (IN).

g. Drainage system No. 53.

(1) Ditch 53.

(a) Deepen and improve channel downstream from junction with 53-A until definite flow is maintained. (LRD).

(b) Pave invert and side slopes from junction with 53-A to beginning of existing paved section. (LRD). Pave side slopes from the latter point to junction with 53-J. (LRD). Recondition side walls from junction with 53-B to end. (IN). Clean and regrade section above junction with 53-Q. (IN).

(2) Ditch 53-A. Pave invert and/or install one-half round invert tile from junction with 53 to 20" culvert at junction with 53-A-8. (IN). Pave side slopes from junction with 53 to junction with 53-A-6. (LRD).

(3) Ditches 53-A-1, 53-A-2, 53-A-3, 53-A-4, 53-A-5 and 53-A-6. Install one-half round invert tile and include the indicated tributaries to these ditches. (IN).

(4) Ditch 53-A-7. Install one-half round invert tile from junction with 53-A to next culvert under highway. Eliminate the swampy area around junction of 53-A-7 with 53-A by the use of one-half round invert tile, sub-surface drains and fill. (IN).

(5) Ditch 53-B. Clean and repair side walls from junction with 53 to culvert under railroad just above junction with 53-B-4. (IN). Pave side slopes of this same section. (LRD). See subsequent report for recommendations for remainder of this ditch.

(6) Ditches 53-B-1, 53-B-2 and 53-B-3. Install one-half round invert tile. Include the several tributaries to ditch 53-B-3. (IN).

(7) Ditches 53-C, 53-D and 53-E. Install one-half round invert tile. Include the several tributaries to ditch 53-E. (IN).

(8) Ditch 53-F. Complete installation of one-half round invert tile in this ditch. (IN).

(9) Ditch 53-F-1. Install one-half round invert tile, changing location as required to remove it from under the building being constructed over it. (IN).

(10) Ditch 53-F-1-A and 53-F-1-B. Install one-half round invert tile. (IN)

(11) Ditch 53-G. Install one-half round invert tile from junction with 53 to junction with 53-G-1. (IN).

(12) Ditch 53-H. Pave side slopes from junction with 53 to section where side slopes are now paved. (LRD).

(13) Ditch 53-H-1. Abandon and fill from junction with 53-H to outlet of 12" culvert just below junction with 53-H-1-A, diverting ditch above the outlet of the 12" Culvert direct to ditch 53-H. Complete unpaved sections and reset 12" culvert just below junction with 53-H-1-C. (IN).

(14) Ditches 53-H-1-A, 53-H-1-B and 53-H-1-C. Install one-half round invert tile including the indicated tributaries. (IN).

(15) Ditch 53-H-2. Install one-half round invert tile from junction with 53-H to 20 feet above junction with 53-H-2-A. (IN).

(16) Ditches 53-J, 53-J-1, 53-K and 53-L. Install one-half round invert tile. (IN).

(17) Ditch 53- \*\*. Complete to junction with 53. (IN).

(18) Ditches 53-N and 53-N-1. Install one-half round invert tile. (IN).

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(19) Ditch 53-Q. Clean and regrade, section from intersection with 53 to inlet of next 15" culvert. Install one-half round invert tile above the 15" culvert. (IN).

(20) Ditches 53-Q-1 and 53-Q-1-A. Install one-half round invert tile.(IN).

(21) Ditch 53-R. Regrade upper section and install sub-surface drain in seepage area at end. (IN).

h. Miscellaneous items in area tributary to Drainage System No. 53.

(1) Regrade the triangular area between ditches 53-F and that section of 53 between junction with 53-F and 53-M. (IN).

(2) Fill and grade the area around the upper end of 53-N to drain into this ditch. (IN).

(3) Fill extensive and deep ruts along the road leading from junction of 53-F with 53-F-1 in the direction of 53-A-2. (IN).

(4) Reconstruct wooden bridges across ditches 53 and 53-C, each located about 150 feet upstream from junction of 53-C with 53 so that they are not definite obstructions to flow. (IN).

(5) Fill large hole caused by uprooted tree located near junction of 53-B and 53-B-1. (IN).

(6) Remove dike caused by cable crossing ditch 53-F at a point about \*\*5 feet above its junction with ditch 53. (IN).

k. Drainage system No. 54.

(1) Ditch 54. Deepen and improve downstream from junction with 54-A until definite flow is maintained. (IN). Pave invert and side slopes from elevation 6.0 to junction with 54-A. (LRD). Install one-half round invert tile in remainder of ditch. (IN). Reset and enlarge as required and recondition the area around the 3 - 12" culverts and the sanitary sewer crossing located about 200 feet below junction with 54-B. (IN). Pave side slopes from junction with 54-A to the \*\* - 24" culverts located 100 feet above junction with 54-D. (LRD).

(2) Ditches 54-A and 54-A-2. Install one-half round invert tile with fill and sub-surface drains as required to completely dry up the extensive seepage areas at ends of 54-A and 54-A-2. (IN).

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(3) Ditch 54-A-1. Cut channel from 54-A to lower end of 54-A-1 and install one-half round invert tile. (LRD). Complete installation of one-half round invert tile in section between junction with 54-A-1-A and 54-A-1-C. (IN).

(4) Ditch 54-B. Complete installation of one-half round invert tile. (IN).

(5) Ditches 54-C and 54-D. Fill and/or install one-half round invert tile. (IN).

(6) Ditches 54-E and 54-E-1. Install one-half round invert tile. (IN).

1. Miscellaneous items in area tributary to drainage system No. 54.

(1) Regrade area located about 300 feet north of end of ditch 54-1-A. (IN).

(2) Fill numerous ruts located about 300 feet west of the end of ditch 54-A. (IN).

(3) Fill numerous ruts located near end of ditch 54-A-2. (IN).

(4) Install sub-surface drains along foot of slope paralleling ditch 54-E and about 50 feet north of it. Connect it into ditch 54. (IN).

(5) Complete unpaved section of roof drainage system for power station located about 200 feet northwest of Post Theater. (IN).

m. Drainage System No. 55.

(1) Ditch 55. Regrade and improve section below junction with 55-A. Avoid the destruction of shade. (IN). Pave invert and side slopes from elevation 6.0 to junction with 55-A. (LRD). Pave invert and side slopes from junction with 55-A to junction with 55-D. (IN).

(2) Ditches 55-A and 55-A-1. Install one-half round invert tile in sections now unpaved. (IN).

(3) Ditch 55-B. Install one-half round invert tile and sub-surface drain to seepage area at end. (IN).

(4) Ditch 55-C. Pave invert and side slopes and/or install concrete storm sewer. (IN).

(5) Ditch 55-C-1. Pave invert and side slopes and/or install concrete storm sewer, connecting it to ditch 55-C. (IN).

(6) Ditch 55-D. Install one-half round invert tile in section now unpaved. (IN).

(7) Install one-half round invert tile along south side of barracks and along toe of slope near this barracks as indicated in red on Drawing M.C. 10. (IN).

n. Drainage System No. 56.

(1) Ditch 56. Install one-half round invert tile from elevation 6.0 to end of ditch with sub-surface drain into seepage area about 250 feet from end. (IN).

p. Drainage System No. 57.

(1) Ditch 57. Pave invert and side slopes from a point about 500 feet below junction with 57-D to junction with 57-F. Install one-half round invert tile from junction with 57-F to end. (IN).

(2) Ditches 57-A, 57-B and 57-C. Combine into one system. Cut new ditch to ditch 57 and install one-half round invert tile in the entire system. (IN).

(3) Ditch 57-A-1. Install one-half round invert tile and sub-surface drain to eliminate seepage area at end. (IN).

(4) Ditch 57-D. Install one-half round invert tile from junction with 57 to the 20" culvert located about 200 feet above junction with 57-D-5. (IN).

(5) Ditches 57-D-1, 57-D-2, 57-D-3, 57-D-4 and 57-D-5. Install one-half round invert tile. (IN)

(6) Ditches 57-E, 57-F and 57-G. Install one-half round invert tile. (IN).

(7) Fill extensive ruts located on east side of warehouse about 300 feet northeast of end of ditch 57-A. (IN).

(8) Regrade area located between Field Commissary Building and ditch 57-D. (IN).

(9) Eliminate the extensive swampy area located in the V between ditches 57 and 57-E by the use of fill and one-half round invert tile ditches. (IN).

(10) Eliminate large hole and seepage area located about 200 feet north of end of ditch 57-G by the use of fill and a sub-surface drain connected to the existing sanitary sewer located about 30 feet west of the seepage area. (IN).

(11) Eliminate water pooling around car wash rack located near end of ditch 57-B.



g. Drainage system No. 58.

(1) Ditch 58. Straighten, deepen and cut new channel as required downstream from the 2 - 8' x 8' culverts under Howard Ave. until a definite channel flow is maintained from Howard Ave. to the Farfan River. At the present, this ditch spreads into a swamp beginning about 250 feet east of Howard Ave. (IN). Improve the flow characteristics of ditch 58 from Howard Ave. to a point 800 feet above junction with 58-J by simple re-grading and removing obstructions to flow, taking particular care to avoid the destruction of shade. (IN). Pave invert and side slopes from elevation 6.0 to the point 800 feet above junction with 58-J. (LRD).

(2) Ditches 58-A and 58-B. Install one-half round invert tile. (IN).

(3) Ditch 58-C. Install one-half round invert tile from junction with \*\*8 to the point where the existing paving begins. (IN).

(4) Ditch 58-D. Pave invert and side slopes from junction with 58 to the 24" culvert about 700 feet above junction with 58-D-3. (IN). Install one-half round invert tile for 60 feet above the 24" culvert. (IN).

(5) Ditches 58-D-1 and 58-D-2. Install one-half round invert tile. (IN).

(6) Ditches 58-E, 58-F and 58-F-1. Install one-half round invert tile. (IN).

(7) Ditch 58-G. Install one-half round invert tile. (IN).

(8) Ditches 58-H and 58-H-1. Install one-half round invert tile. (IN).

(9) Ditch 58-J. Install one-half round invert tile from junction with \*\*8 to 100 feet above junction with 58-J-3. (IN).

(10) Ditches 58-J-1, 58-J-2, 58-J-2-A and 58-J-3. Install one-half round invert tile. (IN).

(11) Fill low area located about 200 feet southwest of end of ditch 58-\*\*. (IN).

(12) Fill and/or drain swamps located on both sides of Howard Ave. about 200 feet south of point where ditch 58 crosses this Avenue. (IN).

(13) Provide an outlet for and install one-half round invert tile in ditch located along west side of Howard Ave. in the District Engineer storage yard. (IN).



r. Drainage system No. 59.

(1) Ditch 59. Improve flow characteristics of ditch from junction with 59-A to culvert 300 feet above junction with 59-\* by simple regrading and removing obstructions to flow. Avoid the destruction of shade. (IN). Regrade around culverts under road to Naval Reservation just below junction of 59-H with 59. (IN). Drain and/or fill the secondary channel just below junction of 59 and 59-L. (IN). Pave invert and side slopes from elevation 6.0 to culvert 300 feet above junction with 59-P. (LRD).

(2) Ditch 59-A. Improve flow characteristics of ditch from junction with 59 to junction with 59-A-10 by simple regrading and removing obstructions to flow, avoiding the destruction of shade. (IN). Pave invert and side slopes of same section. (LRD).

(3) Ditch 59-A-1. Install one-half round invert tile. (IN).

(4) Ditches 59-A-2 and 59-A-2-A. Install one-half round invert tile. (IN).

(5) Ditch 59-A-3. Install one-half round invert tile for 200 feet above junction with 59-A. Install culvert under road located about 150 feet above junction with 59-A and regrade remainder of ditch. (IN).

(6) Ditches 59-A-4 and 59-A-4-A. Install one-half round invert tile. (IN).

(7) Ditch 59-A-5. Regrade lower end. (IN).

(8) Ditch 59-A-6. Install one-half round invert tile. Include the indicated tributaries. (IN).

(9) Ditches 59-A-8, 59-A-9 and 59-A-10. Install one-half round invert tile. (IN).

(10) Install inlet box and storm sewer for street intersection located \*30 feet northwest of junction of 59-A with 59-A-3. (IN).

(11) Eliminate by the use of fill and one-half round invert tile ditches the extensive swampy area located west of the junction of 59-A-6 and 59-A-6-F. (IN)

(12) Drain abandoned gun positions located along each side of ditch 59-A-8. (IN).

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(13) Eliminate pooling of water along pipe line extending generally from the 24" culvert in ditch 59-A-9 to the 24" culvert in ditch 59-A-6 just below junction with 59-\*\*\*-6-F. Simple regrading will suffice. (IN).

(14) Ditches 59-B, 59-C, 59-D and 59-E. Install one-half round invert tile. (IN).

(15) Ditches 59-F, 59-F-1, 59-F-1-A and 59-F-2. Install one-half round invert tile. Eliminate extensive swampy areas at ends of each of these ditches by the use of fill and one-half round invert tile ditches. (NFD).

(16) Ditches 59-I, 59-J, 59-K, 59-M, 59-N and 59-P. Regrade these ditches. (IN).

(17) Ditch 59-L. Install one-half round invert tile from junction with 59 to 400 feet above junction with 59-L-1. (NFD).

(18) Ditch 59-L-1. Regrade. (NFD).

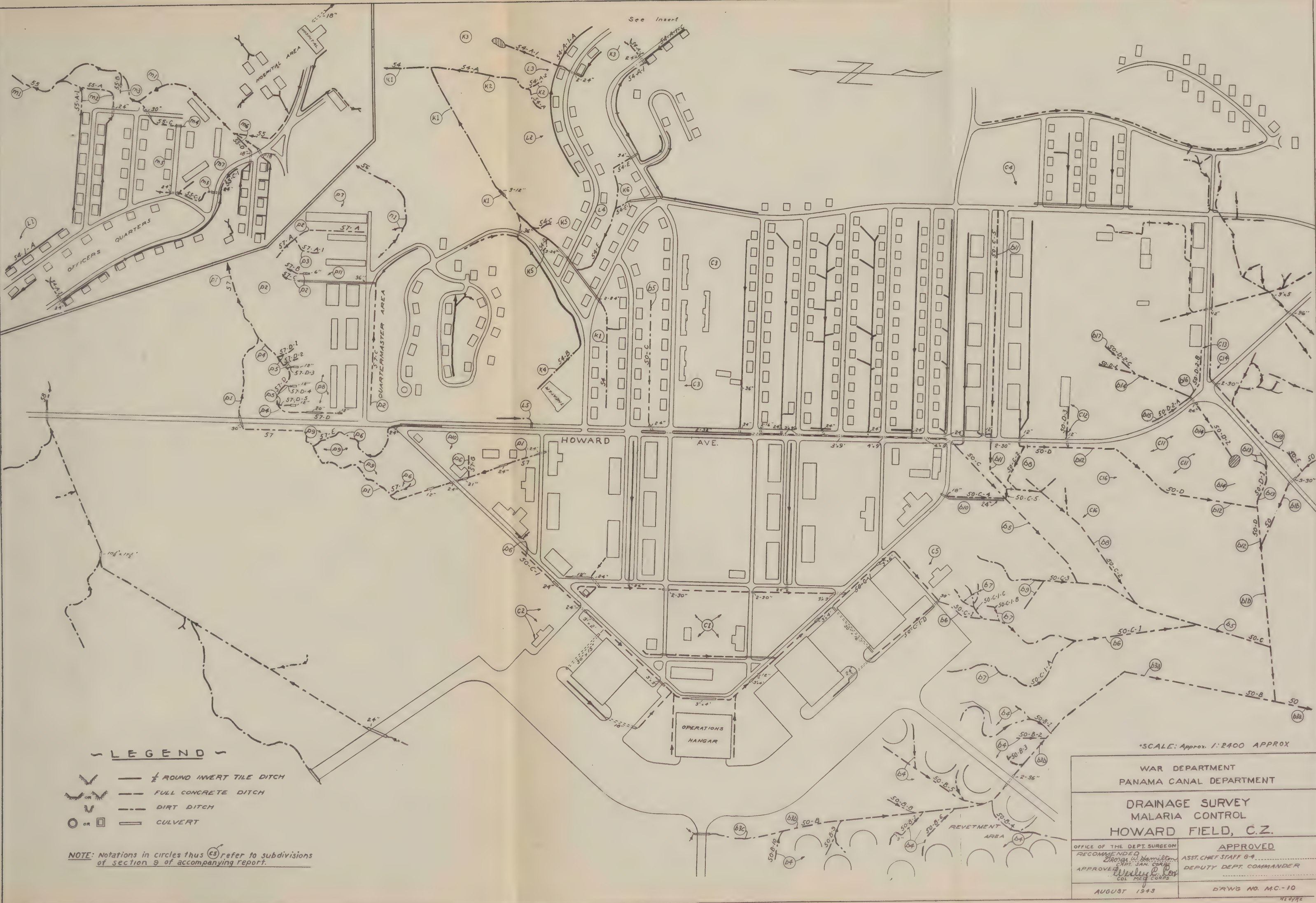
s. Miscellaneous improvements.

(1) Locate definitely the elevation 9.0 contour in the valleys of ditches 50, 51, 53, 54, 55, 56, 57, 58 and 59 by an engineering survey. Eliminate all swamps adjacent to and above this contour by the use of fill and/or one-half round invert tile ditches. (LRD).

(2) Complete landscaping and grading throughout the area covered by this report with particular emphasis on the filling of ruts, low areas and depressions not specifically pointed out in preceding paragraphs. (IN).

(3) Clean all one-half round invert tile roof drains and regrade any found to retain water in excess of one-half inch. (IN).





LEGEND

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

NOTE: Notations in circles thus (C3) refer to subdivisions of section 9 of accompanying report.

SCALE: Approx. 1:2400 APPROX

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL HOWARD FIELD, C.Z.	
OFFICE OF THE DEPT. SURGEON RECOMMENDED THROUGH U.S. ARMY APPROVED Wesley D. Cox COL MED CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER AUGUST 1943
D'RWG NO. MC-10	





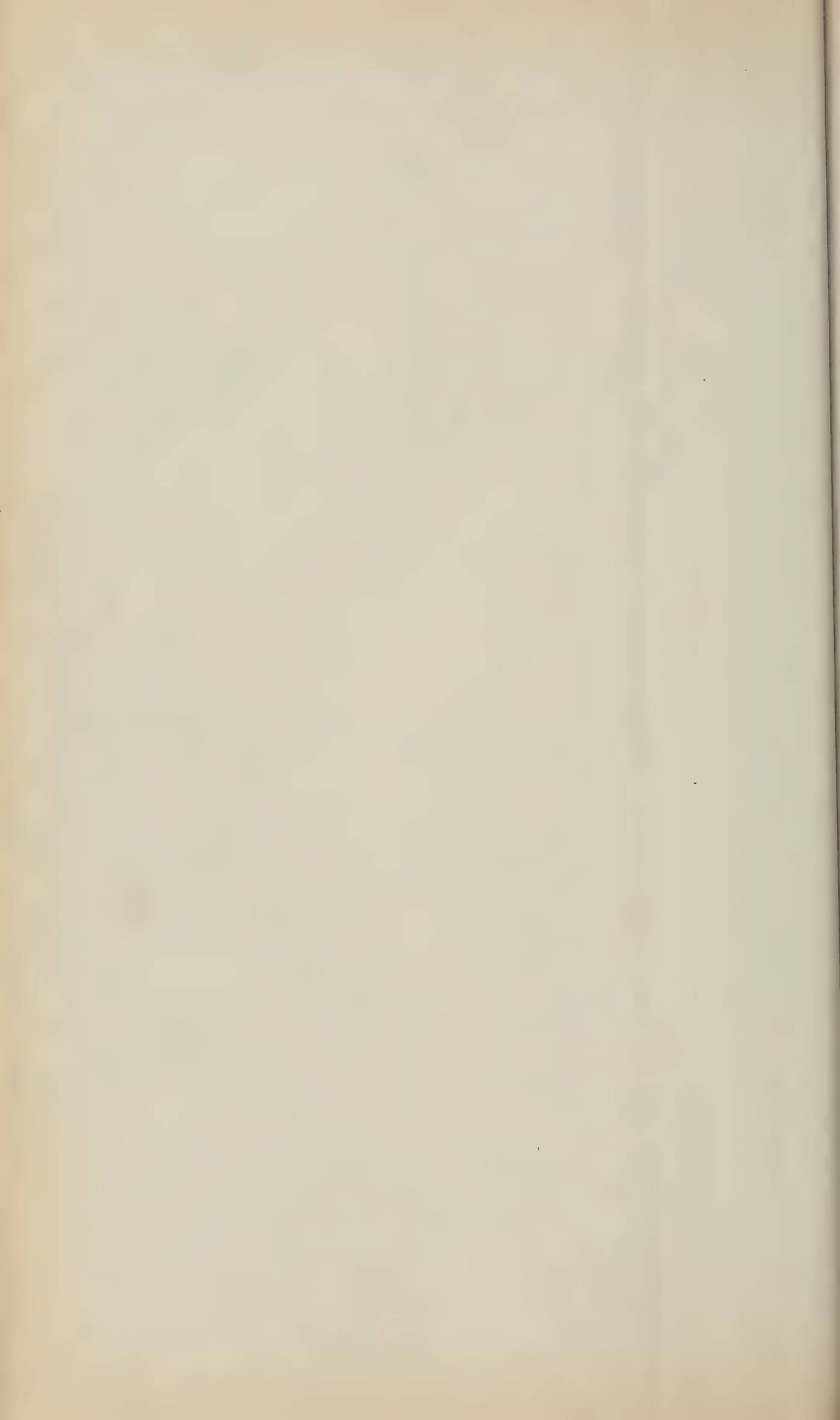


NOTE: Notations in circles thus (h3) refer to subdivisions of section 9 of accompanying report.

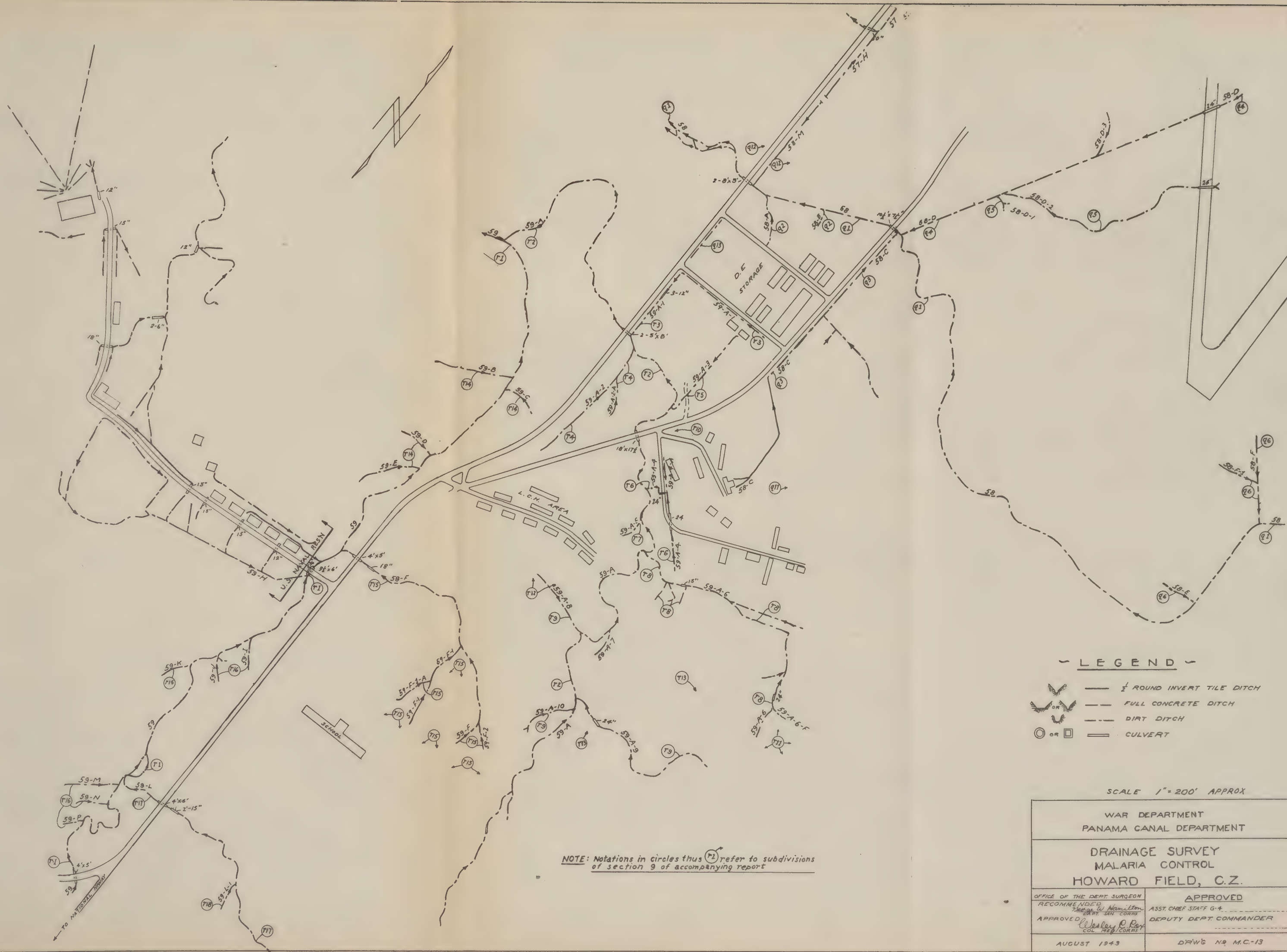
- ~ LEGEND ~
- 1/2 ROUND INVERT TILE DITCH
  - FULL CONCRETE DITCH
  - DIRT DITCH
  - OR CULVERT

SCALE: 1" = 200' APPROX.

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL HOWARD FIELD, C.Z.	
OFFICE OF THE DEPT SURGEON RECOMMENDED ASST. CHIEF STAFF G-4 APPROVED COL MED CORPS	APPROVED DEPUTY DEPT. COMMANDER
SEPT. 1943	DRWG NO. M.C.-11







NOTE: Notations in circles thus (P2) refer to subdivisions of section 9 of accompanying report

# LEGEND

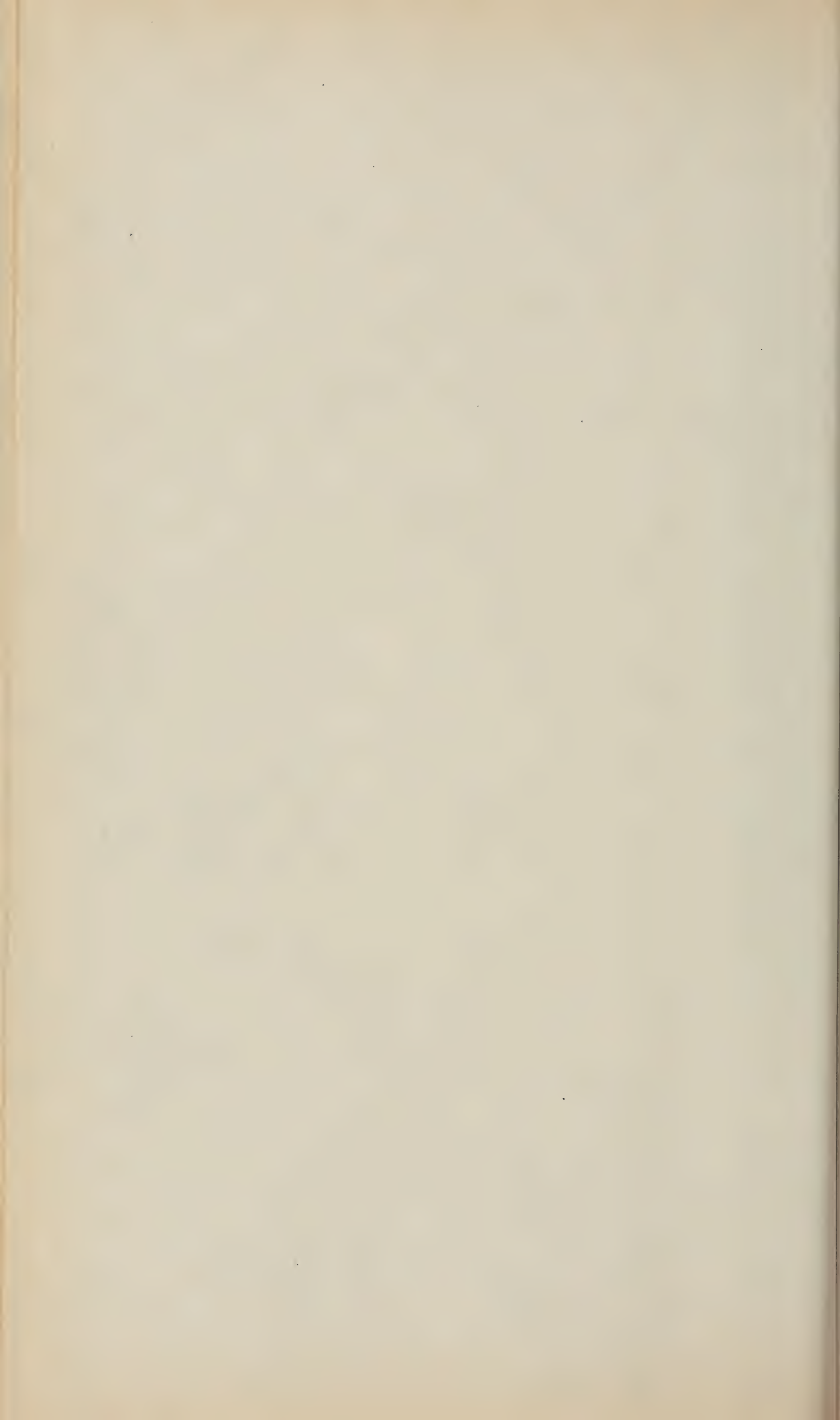
- 1/2" ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

SCALE 1" = 200' APPROX

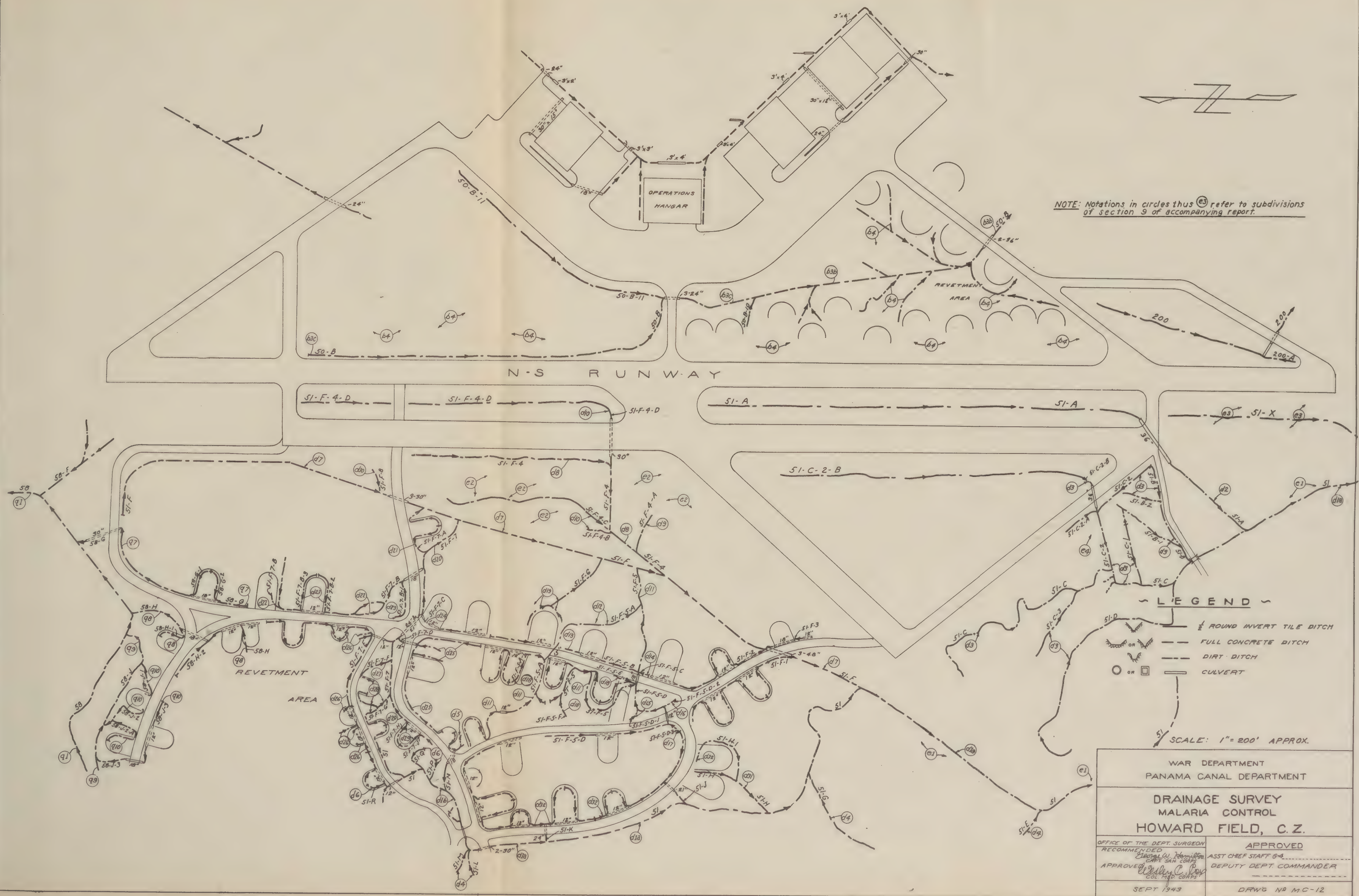
WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
HOWARD FIELD, C.Z.

OFFICE OF THE DEPT. SURGEON RECOMMENDED Major W. M. Hamilton Chief San. Corps.	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
APPROVED: Wesley D. Ray COL. MED. CORPS.	
AUGUST 1943	DFWC NO. M.C.-13







NOTE: Notations in circles thus (e3) refer to subdivisions of section 9 of accompanying report.

~ L E G E N D ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

SCALE: 1" = 200' APPROX.

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
HOWARD FIELD, C.Z.

OFFICE OF THE DEPT. SURGEON RECOMMENDED CAPT. W. J. Hamilton CAPT. SAN CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
SEPT 1943	DRWG NO MC-12





MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

2 NOVEMBER 1943.





10. SPECIFIC REPORT ON QUARRY HEIGHTS (AREA NO. 7).

a. Area included - Quarry Heights and vicinity as indicated by accompanying Map M.C. 14.

b. Drainage system No. 60.

(1) Ditch 60. Reshape bottom of inlet box near sentry house to eliminate trapped water. (IN).

(2) Ditches 60-A and 60-B. Install one-half round invert tile. (IN).

c. Drainage system No. 61.

(1) Ditch 61. Eliminate extensive seepage area just above junction with 61-A by the use of sub-surface drains. (IN). Install one-half round invert tile in the section now unpaved above junction with 61-B. (IN).

d. Drainage system No. 62.

(1) Ditch 62. Repair side walls to eliminate seepage pockets. (IN).

(2) Ditch 62-A. Install one-half round invert tile. (IN).

e. Drainage system No. 63.

(1) Ditch 63. Repair broken section about 60 feet upstream from inlet to 15" culvert. (IN). Eliminate seepage pockets in ditch slopes for 60 feet upstream from inlet to 15" culvert by the use of concrete side walls or sub-surface drains. (IN).

f. Miscellaneous improvements.

(1) Pave inlet and outlets of the several culverts under the road leading from Quarry Heights to the radio station on top of Ancon Hill. (IN).

(2) Install sub-surface drain in ground water outcrop in bank below carrier pigeon lofts. Connect into storm sewer. (IN).

(3) Repair roof drainage system in front of Bldg. 327 to eliminate the complete stoppage of this drain. (IN).

(4) Fill ruts and large holes along and at extreme end of road leading from the main Ancon Hill access road to an abandoned gun position. (IN).

(5) Eliminate water standing in a small concrete box in the ground at the south end of the parade grounds. (IN).

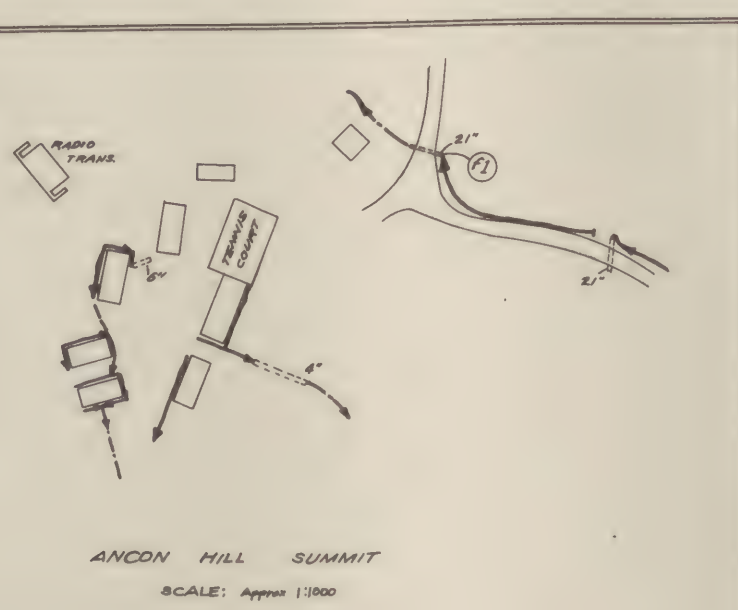
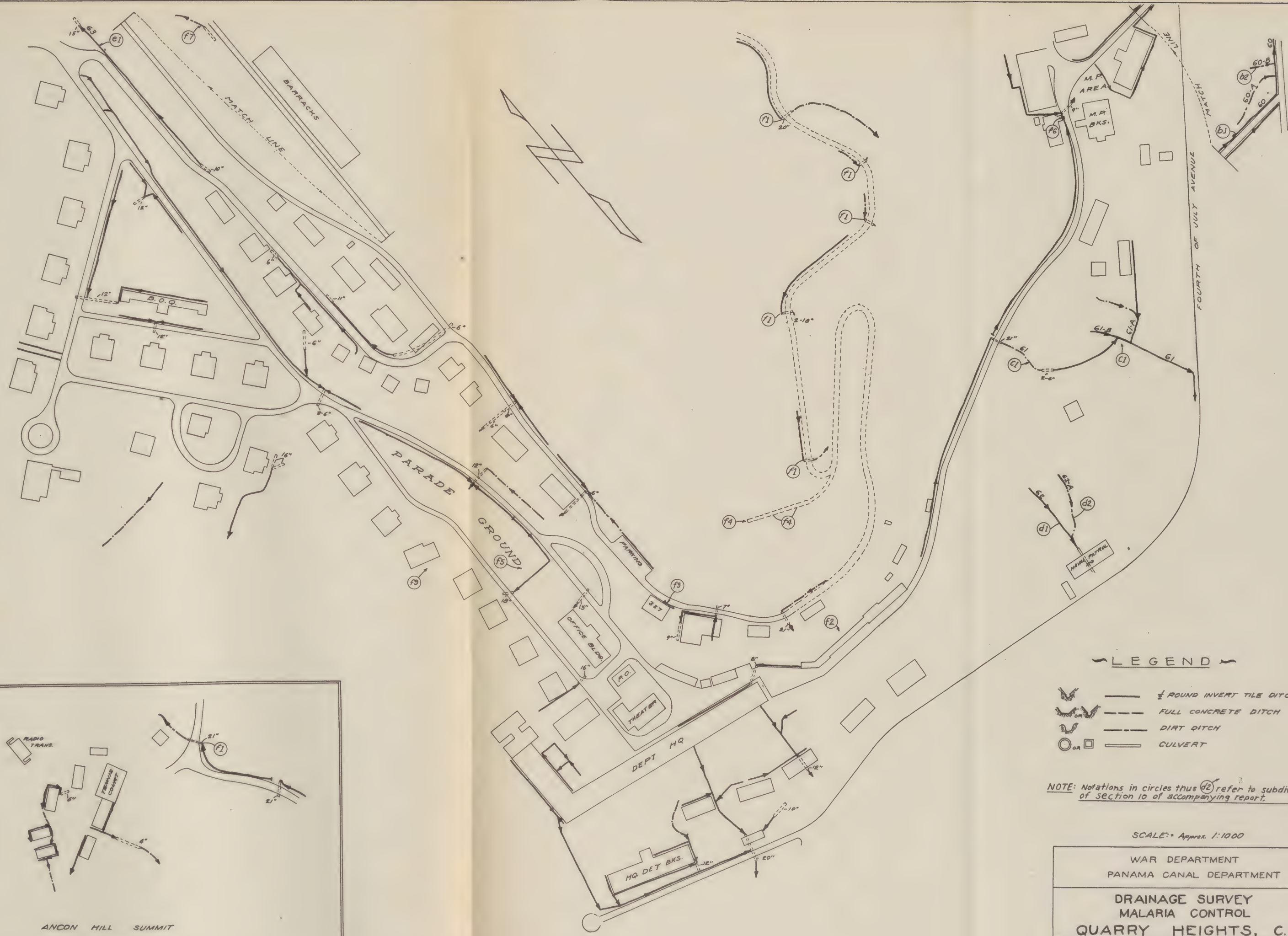
(6) Reshape bottom of inlet box in drain located on east side of road in front of Military Police Barracks. (IN).

(7) Pave outlet for culvert near 516th Signal Aircraft Warning Barracks. Regrade ditch below this culvert. (IN).

(8) Provide one-half round invert tile roof drain systems for principal houses and buildings not now so equipped and regrade around these houses and buildings to eliminate holes and depressions that impound water. (IN).

(9) Repair leaky water hydrant in yard about 50 feet southwest of Post Restaurant No. 2. (IN).





LEGEND

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

NOTE: Notations in circles thus (d2) refer to subdivisions of section 10 of accompanying report.

SCALE: Approx. 1:1000

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
QUARRY HEIGHTS, C.Z.

OFFICE OF THE DEPT. SURGEON	
RECOMMENDED <i>Charles W. Hamilton</i> CAPT., SAN. CORPS	ASST. CHIEF STAFF & 4
APPROVED <i>Walter L. Cox</i> COL., MED. CORPS	DEPUTY DEPT. COMMANDER
SEPT. 1949	DRWG NO. M.C.-14





Recommended George W. Hamilton  
Captain, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_

Deputy Department Commander \_\_\_\_\_





MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

2 NOVEMBER 1943



11. SPECIFIC REPORT ON FORT AMADOR ( AREA NO. 8 )

a. Area included - Fort Amador and vicinity as indicated by accompanying Map M.C. 15.

b. Drainage system No. 64.

(1) Ditch 64. Stabilize side slopes for 400 feet upstream from entrance to 21" culvert by the use of sod or concrete. (IN). Pave side slopes at point where sanitary sewer crosses ditch about 500 feet upstream from 21" culvert. (IN).

c. Drainage system No. 65.

(1) Ditch 65. Clean culvert and reshape inlet to avoid trapping of water. (IN).

d. Drainage system No. 66.

(1) Ditch 66. Clean thoroughly and install one-half round invert tile in upper section. (IN).

e. Drainage system No. 67.

(1) Ditch 67-A. Install one-half round invert tile in upper section. (IN).

f. Miscellaneous improvements.

(1) Regrade road ditches between railroad and highway along the northern end of the causeway to Flamenco Island, in front of the bowling alley and opposite the tent area. Install new culverts under railroad to eliminate the extensive pooling of water in these ditches. (IN).

(2) Fill extensive and deep ruts in area south of bowling alley including the newly filled area extending into the Bay of Panama.

(3) Fill, regrade and install one-half round invert tile drain to completely dry up the area north of the bowling alley. (IN).

(4) Fill ruts and holes in road along water front about 500 feet north of bowling alley. (IN).

(5) Fill and/or drain area about 400 feet east of Post Theater. (IN).

(6) Fill ruts in area about 200 feet west of Post Theater. (IN).

(7) Regrade area about 50 feet east of hangar. (IN).



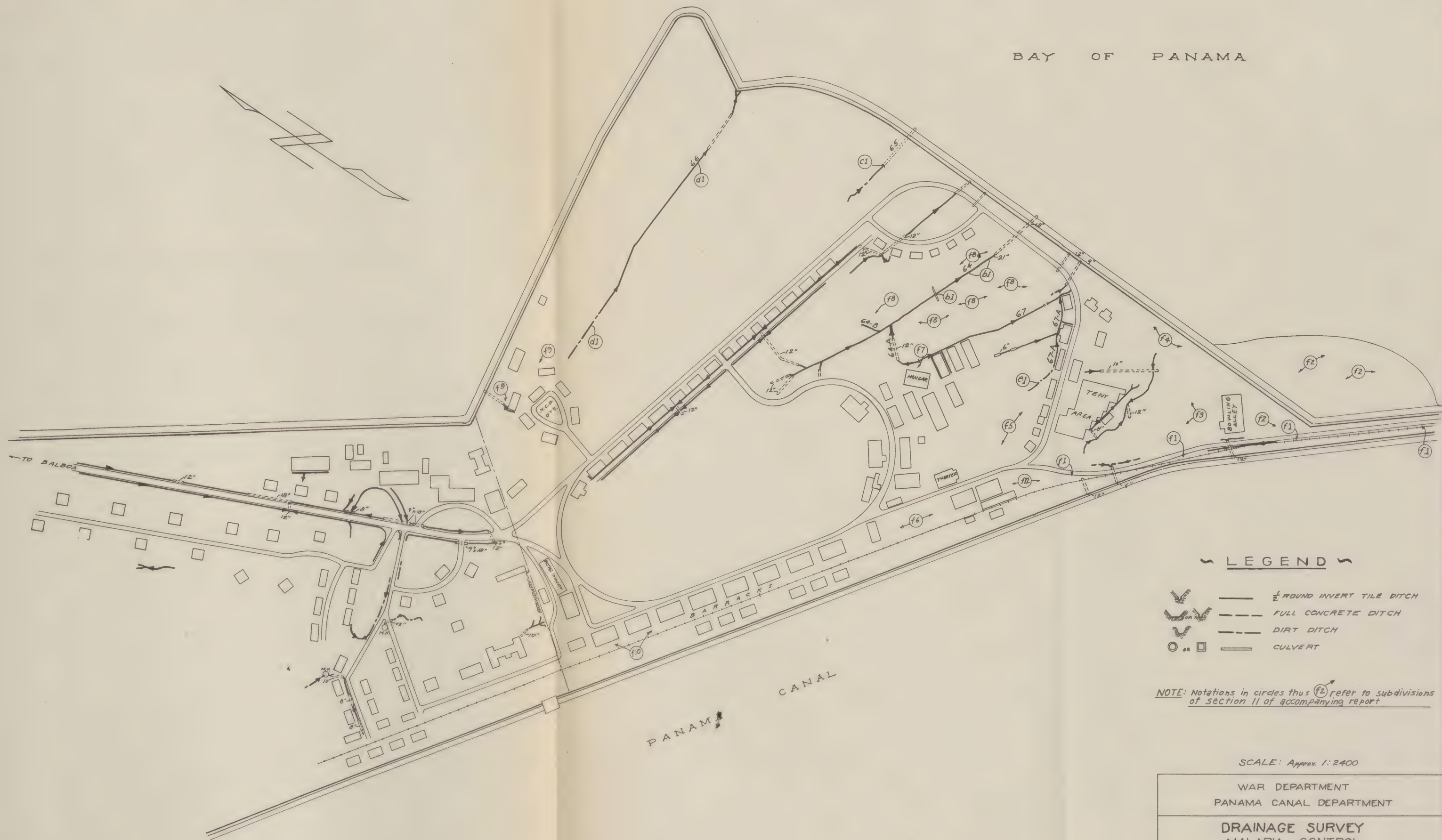
(8) Fill ruts and regrade area on each side of ditch 64 below junction with 64-B. (IN).

(9) Fill ruts in rear of noncommissioned officers' quarters. (IN).





(10) Fill ruts in front of and between barracks in southwestern quadrant of post. (IN).

(11) Eliminate water standing in sand traps and other low areas and depressions throughout the entire golf course. (IN).

(12) Regrade area about 150 feet south of Ordnance Machine Shop. (IN).



# ~ LEGEND ~

-  1/2 ROUND INVERT TILE DITCH
-  FULL CONCRETE DITCH
-  DIRT DITCH
-  CULVERT

NOTE: Notations in circles thus (f2) refer to subdivisions of section II of accompanying report

SCALE: Approx. 1:2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
FORT AMADOR, C.Z.

OFFICE OF THE DEPT. SURGEON	APPROVED
RECOMMENDED <i>Lesley P. Box</i> CAPT., SAN. CORPS	ASST. CHIEF STAFF G-4
APPROVED <i>Lesley P. Box</i> COL., MED. CORPS	DEPUTY DEPT. COMMANDER
SEPT. 1943	DRWG NO M.C-15





Recommended George W. Hamilton  
Captain, Sanitary Corps

Approved & Wesley C. Cox  
Colonel Medical Corps

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_

Deputy Department Commander \_\_\_\_\_



MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

22 DECEMBER 1943.





12. SPECIFIC REPORT ON CAMP PARAISO ( AREA NUMBER NINE).

a. Area Included: Camp Paraiso and vicinity as indicated on accompanying Map M.C. 16.

b. Drainage system No. 68.

(1) Ditch 68. Install one-half round invert tile from outlet of culvert near canal bank to canal. Install 50 feet of one-half round invert tile in upper section of ditch 68. (Panama Canal property). (IN).

(2) Ditch 68-B. Repair broken sections. (Panama Canal property). (IN)

(3) Ditch 68-C. Install one-half round invert tile. (Panama Canal property). (IN).

c. Drainage system No. 69.

(1) Ditch 69. Clean 30" culvert under railroad and Gaillard Highway. Pave invert and side slopes from junction with 69-B to junction with 69-D, if this section is not already paved. (Due to a partial stoppage in the 30" culvert, this last mentioned section of ditch is totally submerged and its classification could not be determined). In any event, after unstopping the culvert, completely sanitize the area now covered with water until the whole area is definitely drained with drainage courses paved. Install one-half round invert tile in section now unpaved, just above junction with 69-Q. (All of above Panama Canal property). (IN).

(2) Ditch 69-B. Install one-half round invert tile from junction with 69 to a point about 200 feet upstream from the latter junction where there is definite ground water outcrop. (Panama Canal property). (IN).

(3) Ditch 69-D. Install one-half round invert tile for 150 feet above junction with 69. (Panama Canal property). (IN).

(4) Ditch 69-D-1. Install one-half round invert tile for 100 feet above junction with 69-D. (Panama Canal property). (IN).

(5) Ditch 69-G. Install one-half round invert tile for 50 feet above 24" culvert under Panama Railroad. Regrade area adjacent to this 50 foot section where a pipe line crossing has been made. (Panama Canal property). (IN).

(6) Ditch 69-H. Repair and recondition from junction with 69-H-2 to end. Eliminate seepage areas on east side of ditch about 200 feet above junction with 69-H-2 by the use of sub-surface drains emptying into ditch 69-H. (Panama Canal property). (IN).

(7) Ditch 69-H-2. Install one-half round invert tile for 100 feet above junction with 69-H. (Panama Canal property). (IN).

(8) Ditch 69-J. Replace eroded section between junction with 69-J-1 and 69-J-3 with one-half round invert tile. (NFD). Repair invert of ditch for section downstream from junction with 69-J-4. (IN).

(9) Ditch 69-K. Repair broken sections, remove large rocks from, and repair side walls in section from junction with 69 to junction with 69-K-7. Install one-half round invert tile or subsurface drain packed in rocks from junction with 69-K-7 to 30 feet above junction with 69-K-9. (Panama Canal property). (IN).

(10) Ditch 69-K-2. Install one-half round invert tile with subsurface drains into seepage area at upper end. (Panaman Canal Property). (IN).

(11) Ditch 69-K-3. Regrade. (Panama Canal property). (IN).

(12) Ditch 69-K-4. Install one-half round invert tile. (Panama Canal property). (LRD).

(13) Ditch 69-K-6-A. Straighten and install one-half round invert tile from 30" culvert under the Panama Railroad to the beginning of the existing paved ditch paralleling the Railroad. (Panama Canal property). (NFD).

(14) Ditch 69-K-9. Install one-half round invert tile or subsurface drain packed in rocks for 30 feet above junction with 69-K. (Panama Canal property). (IN).

(15) Ditches 69-M-1 and 69-M-2. Install subsurface drains in these ditches. (IN).

(16) Ditch 69-N. Complete installation of one-half round invert tile in lower section and recondition upper section to eliminate trapped water. (IN).

(17) Ditch 69-N-1. Install one-half round invert tile. (LRD).

(18) Ditch 69-P. Install subsurface drain at upper end to eliminate seepage area. (Panama Canal property). (IN).

d. Drainage system No. 70. Ditches 70, 70-B and 70-B-1. Clean and recondition these ditches, regrading if required to eliminate pooling of water. (Panama Canal property). (IN).



e. Miscellaneous items in area tributary to drainage systems 68 to 72 inclusive.

(1) Regrade area located about 100 feet north of junction of ditches 68-C and 68. (Panama Canal property). (IN).

(2) Fill, regrade and construct one-half round invert tile ditches as required to completely eliminate the extensive pooling of water in the area bounded by the Gaillard Highway, Camp Paraiso access road, ditch 69-J and end of 69-A-1. Install one-half round invert tile in all existing ditches in this area which are not eliminated by the new grading plan. (Panama Canal property). (IN).

(3) Regrade area located about 100 feet east of junction of ditches 69-G and 69. (Panama Canal property). (IN).

(4) Regrade area located about 300 feet southwest of junction of ditches 69-J and 69-J-3. (Panama Canal property). (IN).

(5) Eliminate seepage area located about 100 feet east of junction of ditches 69-D and 69 by the use of subsurface drains and fill. (Panama Canal property). (IN).

(6) Regrade along road crossing ditch 69-K downstream from the junction of this ditch with 69-K-7. (Panama Canal property). (IN).

f. Drainage system No. 73. Ditch 73. Regrade, including the indicated tributary. (IN).

g. Drainage System No. 74.

(1) Ditch 74. Install one-half round invert tile for approximately 200 feet at the upper end. (Panama Canal property). (IN).

(2) Ditch 74-B. Pave invert and side slopes. (IN).

(3) Ditches 74-C, 74-D-1 and 74-D-2. Regrade if cleaning does not eliminate water standing in these ditches. (IN).

(4) Ditch 74-E. Recondition throughout. Install subsurface drains in seepage areas adjacent to this ditch. Fill ruts and low areas adjacent to ditch. (IN).

(5) Ditch 74-E-1. Install one-half round invert tile and regrade on each side of ditch. (IN).

(6) Ditch 74-F. Install 400 feet of one-half round invert tile in upper section. (LRD).

(7) Ditch 74-G. Recondition invert at point just above junction with 74-G-4. (IN).

(8) Ditch 74-G-1. Install one-half round invert tile. (IN).

(9) Ditch 74-H. Recondition. (IN).

(10) Ditch 74-J. Recondition section just below junction with 74-J-1. (IN).

(11) Ditch 74-J-1. Install approximately 60 feet of one-half round invert tile in unpaved section of ditch just above junction with 74-J. (IN).

(12) Ditch 74-J-1-A. Install subsurface drain with additional branches as required to eliminate seepage areas adjacent to this ditch. (IN).

(13) Ditch 74-K. Clean and recondition lower end. (IN).

(14) Ditch 74-M. Install approximately 250 feet of one-half round invert tile in upper section. (IN).

(15) Ditch 74-M-1. Install approximately 100 feet of one-half round invert tile in upper section, with regrading and subsurface drains to eliminate pooling of water. (IN).

(16) Ditch 74-N. Install approximately 40 feet of one-half round invert tile in upper section. (IN).

(17) Ditch 74-P. Pave inlet to 24" culvert under Gaillard Highway. Regrade ditch for about 150 feet above this point. (Panama Canal property). (IN).

(18) Ditch 74-P-1. Install 100 feet of one-half round invert tile above 18" culvert under camp access road. (IN).

(19) Ditch 74-Q. Install one-half round invert tile from junction with 74 to 50 feet above junction with 74-Q-1. (IN).

(20) Ditch 74-Q-1. Install one-half round invert tile for 50 feet above junction with 74-Q. (IN).

(21) Ditches 74-R, 74-R-1 and 74-S. Install one-half round invert tile. (IN).

(22) Ditch 74-T. Repair invert and pockets in side slopes. (IN).



(23) Ditch 74-V. Install one-half round invert tile in unpaved section just above junction with 74. (IN).

(24) Ditch 74-V-1. Install one-half round invert tile. (IN).

(25) Ditch 74-W. Install one-half round invert tile from inlet to 24" culvert under Gaillard Highway to end of system. (Panama Canal property). (IN).

h. Drainage system No. 75. Ditch 75. Clean and regrade. (IN).

k. Drainage system No. 76.

(1) Ditch 76. Install one-half round invert tile or subsurface drain packed in rock from canal to the 20" culvert under street. (IN).

(2) Ditch 76-A. Install one-half round invert tile or subsurface drain packed in rock from junction with 76 to where existing paved section begins. (IN).

m. Drainage system No. 77. Ditch 77. Install one-half round invert tile for 100 feet from Canal. (IN).

n. Drainage system No. 78. Ditch 78. Replace section for about 60 feet from Canal with subsurface drain packed in rock. (IN). Replace approximately 200 feet of paved section of ditch at point where paved section joins subsurface drain system. (IN). Install approximately 200 feet of one-half round invert tile below outlet of 6" subsurface drain. (IN).

p. Drainage system No. 79.

(1) Ditch 79. See subsequent report for recommendations for this ditch for section downstream from point 50 feet below 24" culvert under Gaillard Highway. Install one-half round invert tile for 50 feet on each end of this culvert. (Panama Canal property). (IN).

(2) Ditch 79-G. Install one-half round invert tile. (Panama Canal property). (IN).

q. Miscellaneous items in area tributary to Drainage Systems 73 to 79 inclusive.

(1) Fill extensive and deep ruts and holes in areas south and east of Post Exchange building. (IN).

(2) Fill extensive and deep ruts in area at end of ditch 69-j-4. (IN).

(3) Fill ruts and regrade area in the V between ditches 74 and 74-E. (IN).



(4) Install 50 feet of one-half round invert tile along west side of road at northeast corner of Post Headquarters building. (IN)

(5) Regrade around Post Headquarters building and the volley ball court about 100 feet west of this building. (IN).

(6) Fill ruts and depressions in area between ditches 74-F and 74-H. Extensive breeding was found in these ruts on date of this survey. (IN).

(7) Eliminate seepage areas on east side of ditch 74 between junctions of 74 with 74-M and 74-P. Use fill and additional subsurface drains to supplement those drains already constructed. (IN).

(8) Regrade entire area in the V between ditches 74 and 74-M filling extensive ruts and holes. Install one-half round invert tile in the several main valleys of this area which together with proper regrading will convert this area into an adequately drained one. (NFD).

(9) Install subsurface drain in seepage area near junction of 76-B and 76. (IN).

(10) Clean end of 12" culvert located about 300 feet northwest of junction of 76 and 76-A. Install 50 feet of one-half round invert tile downstream from outlet of culvert. (IN).

(11) Regrade ditch along side firing line at pistol range. (IN).

(12) Install 20 feet of subsurface drain into seepage area in the V between ditches 78 and 78-B. (IN).

(13) Install subsurface drains into seepage areas located respectively about 150 feet southwest and 100 feet northeast of junction of 74-J and 74-J-1. (IN).

(14) Install subsurface drains to eliminate extensive ground water out-crops in the hill side west of the motor pool building. Drain the upper level into ditch 74-V-1 and the lower level into ditches 74-V, 74-M-1-B and/or 74-J-1. (IN).

(15) Fill and install one-half round invert tile and/or subsurface drains to eliminate extensive pooling of water in the V between ditches 74 and 74-G. (IN).



# ~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- 18" CULVERT

NOTE: Notations in circles thus (62) refer to subdivisions of section 12 of accompanying report.

SCALE: Approx 1:2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
PARAISO, C. Z.

OFFICE OF THE DEPT. SURGEON

RECOMMENDED *George W. Hamilton*  
CAPT, SAN. CORPS  
APPROVED *Walter P. Row*  
COL, SAN. CORPS

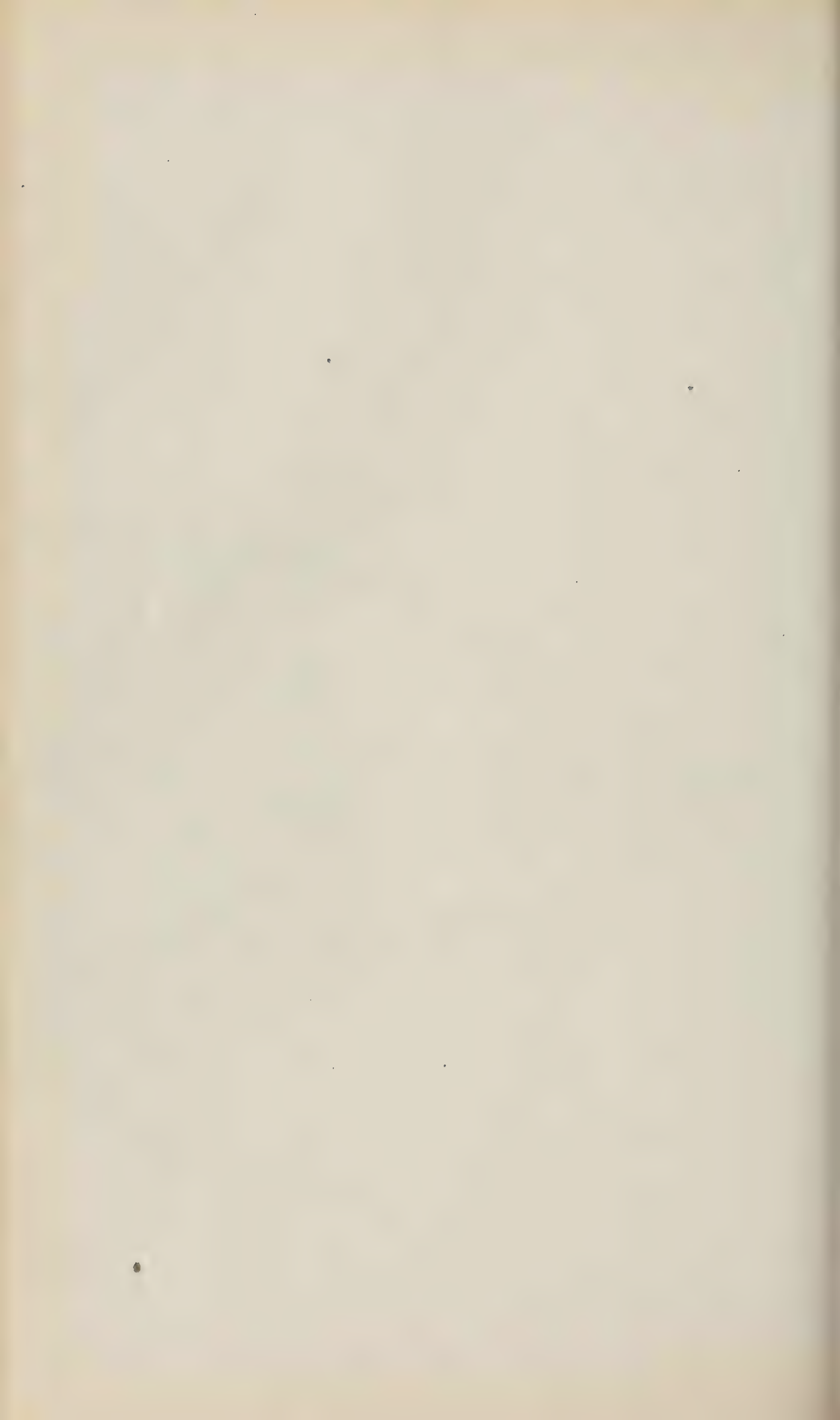
SEPT. 1943

APPROVED

ASST. CHIEF STAFF G-4  
DEPUTY DEPT. COMMANDER

D'WG NO MC-16







Recommended George W. Hamilton  
Captain, Sanitary Corps

Approved Wesley C. Cox  
Colonel Medical Corps.

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_

Deputy Department Commander \_\_\_\_\_



MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT-

22 DECEMBER 1943.





13. SPECIFIC REPORT ON OUTLYING AREA IN VICINITY OF FORT CLAYTON. ( AREA NUMBER TEN).

a. Area included. Area in vicinity of Fort Clayton as indicated on accompanying Map M.C. 17.

b. Drainage system No. 41. Continued from report on Fort Clayton (7v).

(1) Ditch 41. Install subsurface drain packed in large rocks from junction with 41-G to the 24" culvert just below junction with 41-L. Install one-half round invert tile for 50 feet upstream from this culvert. (LRD).

(2) Ditch 41-G. Install subsurface drain packed in large rocks from junction with 41 to the 24" culvert about 250 feet from end of system. Install one-half round invert tile from this 24" culvert to end of system. (LRD).

(3) Ditch 41-H. Install one-half round invert tile. (IN).

(4) Ditches 41-G-1 and 41-G-2. Install subsurface drains packed in large rocks. (LRD).

(5) Ditch 41-G-3. Clean and regrade. (LRD).

(6) Ditches 41-G-5 and 41-G-7. Install subsurface drains packed in large rocks in each of these ditches for 30 feet above their junctions with 41-G. (LRD).

(7) Ditches 41-J, 41-K and 41-K-1. Install subsurface drains packed in large rocks in each of these ditches. Install subsurface drain into seepage area located on south side of ditch 41 just below junction of this ditch and 41-J. (LRD).

c. Drainage system No. 42. Continued from report on Fort Clayton (7w).

(1) Ditch 42. Install subsurface drain packed in large rocks from junction with 42-L to 40 feet upstream from 4" sanitary sewer crossing this ditch. (IN). Unstop this sewer which is now overflowing into ditch 42. (IN).

(2) Ditch 42-H. Install subsurface drain packed in large rocks from a point 100 feet above junction with 42 to end of system. (IN).

(3) Ditches 42-H-1 and 42-H-3. Install subsurface drains packed in large rocks in each of these ditches for 20 feet above their junctions with 42-H. (IN).

(4) Ditch 42-H-2. Install subsurface drains packed in large rocks for 100 feet above junction with 42-H. (IN).

(5) Ditch 42-L. Install subsurface drain packed in large rocks for 100 feet above junction with 42. (IN).

(6) Ditches 42-M and 42-M-1. Install subsurface drains packed in large rocks in these ditches. Include such additional subsurface drains as are necessary to eliminate extensive seepage areas on each side of these ditches in upper reaches. (IN).

(7) Ditch 42-A-1. Install one-half round invert tile in unpaved section and clean upper section which is now paved but totally obstructed. (Panama Canal property). (IN).

(8) Ditch 42-P. Recondition and replace as required the lower section of this ditch and subsurface drain from junction with 42 to junction with 42-P-1 so as to eliminate the extensive swamps in the area near junction of 42-P and 42-P-1. Install one-half round invert tile for 40 feet above junction with 42-P-3. (Panama Canal property). (IN).

(9) Ditch 42-P-1. Recondition and replace with one-half round invert tile or subsurface drain. (Panama Canal property). (IN).

(10) Ditch 42-P-2. Install one-half round invert tile for 150 feet above junction with 42-P-2-A. (Panama Canal property). (IN).

(11) Ditch 42-P-2-A. Install one-half round invert tile for 25 feet above junction with 42-P-2. (Panama Canal property). (IN).

(12) Ditch 42-P-3. Install one-half round invert tile for 40 feet above junction with 42-P. (Panama Canal property). (IN).

(13) Regrade area on top of detention dam at west end to eliminate extensive pooling of water. (IN).

d. Drainage system No. 80.

(1) Ditch 80. Recondition invert and pave side slopes from Canal to the 36" culvert under the Panama Railroad. (Panama Canal property). (LRD). Complete installation of one-half round invert tile from this 36" culvert to junction with 80-F. (IN). Install subsurface drain packed in large rocks from junction with 80-F to 100 feet beyond the point where ditch 80 becomes the south road ditch for the battery road. (IN).

(2) Ditch 80-A. Clean thoroughly. (Panama Canal property). (NFD).

(3)



(3) Ditch 80-C. Recondition side walls and install subsurface drains to eliminate extensive seepage areas on each side of this ditch. Install subsurface drains to eliminate seepage areas along 80 between junctions with 80-B and 80-C. (Panama Canal property). (IN).

(4) Ditch 80-D. Recondition side walls. (Panama Canal property) (IN).

(5) Ditch 80-D-2. Install one-half round invert tile from junction with 80-D to junction with 80-D-2-A. (Panama Canal property). (IN).

(6) Ditches 80-E, 80-F and 80-F-1. Install one-half round invert tile. (IN).

(7) Ditch 80-G. Install one-half round invert tile for 60 feet above junction with 80. (IN).

(8) Ditch 80-H. Install one-half round invert tile for 120 feet above junction with 80. (IN).

(9) Ditch 80-J. Install one-half round invert tile for 150 feet above junction with 80. (IN).

(10) Ditch 80-K. Install subsurface drain packed in large rocks from junction with 80 to 18" culvert at junction of 80-K and 80-K-2. Install one-half round invert tile for the next 100 feet above this 18" culvert and regrade remainder of ditch. (IN).

(11) Ditch 80-K-1. Install one-half round invert tile from junction with 80-K to 20 feet upstream from 18" culvert under highway. (IN).

(12) Ditch 80-K-2. Install one-half round invert tile for 20 feet upstream from 18" culvert at junction of 80-K with 80-K-2. (IN).

(13) Ditch 80-K-2-A. Install one-half round invert tile from junction with 80-K-2 to the indicated 4" pipe. (IN).

(14) Ditch 80-K-2-A-1. Install one-half round invert tile for 20 feet above junction with 80-K-2-A. (IN).

(15) Ditch 80-K-2-A-2. Install one-half round invert tile for 40 feet above junction with 80-K-2-A. (IN).

(16) Ditch 80-M. Install subsurface drain packed in large racks for 200 feet above junction with 80. (IN).

(17) Ditch 80-N. Regrade for 20 feet above junction with 80. (IN).

e. Drainage system No. 81.

(1) Ditch 81. Unstop 24" culvert at lower end. Install one-half round invert tile for 150 feet upstream from this culvert. (Panama Canal property). (IN).

(2) Ditch 81-A. Regrade. (Panama Canal property). (IN).

(3) Ditch 81-B. Regrade. (Panama Canal property). (IN). Install one-half round invert tile. (LRD).

f. Drainage system No. 82.

(1) Ditch 82. Regrade section between junction with 82-D and culvert under Gaillard Highway. (Panama Canal property). (IN).

(2) Ditch 82-A. Straighten and install one-half round invert tile from junction with 82 to junction with 82-A-1. Regrade above this latter point. (Panama Canal property). (IN). Install one-half round invert tile above junction with 82-A-2. (LRD).

(3) Ditch 82-A-1. Regrade. (Panama Canal property). (IN).

(4) Ditch 82-B. Install one-half round invert tile for 150 feet upstream from 15" culvert under Ferry Road. (Panama Canal property). (IN).

g. Drainage system No. 83.

Ditch 83. Install one-half round invert tile from lake to end. (Panama Canal property). (IN).

h. Drainage system No. 84.

Ditch 84. Clean outlet of 20" culvert under Gaillard Highway. (Panama Canal property). (IN).

k. Drainage system No. 85.

(1) Ditch 85. Install subsurface drain packed in large rock from lake to 20 feet upstream from junction with 85-D. (LRD).

(2) Ditches 85-A, 85-B, and 85-C. Install subsurface drain packed in large rock in each of these ditches. (LRD).

(3) Ditch 85-D. Install subsurface drain packed in large rock for 20 feet upstream from junction with 85. (LRD).

m. Drainage system No. 86.

Ditch 86. Install subsurface drain packed in large rock in this ditch, including the tributaries. (LRD).

n. Drainage system No. 88.

(1) Ditch 88. Install subsurface drain packed in large rock from lake to 21" culvert under battery road. (LRD). Regrade remainder of ditch. (IN).

(2) Ditch 88-A. Install subsurface drain for 50 feet above junction with 88. (LRD).

(3) Ditch 88-B. Install subsurface drain for 20 feet above junction with 88. (LRD).

(4) Ditch 88-C. Install subsurface drain for 50 feet above junction with 88. (LRD).

(5) Ditch 88-C-1. Install subsurface drain for 20 feet above junction with 88-C. (LRD).

(6) Ditches 88-D and 88-E. Install subsurface drain packed in large rocks. (LRD).

(7) Ditch 88-F. Install subsurface drain for 20 feet above junction with 88. (LRD).

(8) Ditches 88-G and 88-H. Install subsurface drains in each of these ditches for 50 feet above their junctions with 88. (LRD).

(9) Ditch 88-J. Install subsurface drain packed in large rock. (LRD).

(10) Ditch 88-K. Install subsurface drain packed in large rocks from junction with 88 to 50 feet above junction with 88-K-1. (LRD).

(11) Ditches 88-L and 88-L-1. Install subsurface drain packed in large rocks in each of these ditches. (LRD).

(12) Regrade road ditch located about 700 feet west of end of ditch 41-G. (IN).

p. Drainage system No. 89.

(1) Ditch 89. Install one-half round invert tile. (LRD).

(2) Drain swamp located on west side of ditch 89 at its upper end. (IN).



q. Drainage system No. 90.

(1) Ditch 90. Install one-half round invert tile from lake to 20 feet above junction with 90-A. (LRD).

(2) Ditch 90-A. Install one-half round invert tile for 20 feet above junction with 90. (LRD).

r. Drainage system No. 91.

(1) Ditch 91. Install one-half round invert tile. (LRD).

(2) Regrade trail leading from point near end of ditch 91 in direction of end of ditch 89. Fill ruts, holes and unbackfilled trenches. (IN).

s. Drainage system No. 92.

Ditch 92. Install one-half round invert tile from lake to a point 350 feet upstream from uppermost 24" culvert indicated. (LRD).

t. Drainage system No. 93.

(1) Ditch 93. Install one-half round invert tile from lake to 50 feet upstream from junction with 93-C. (LRD).

(2) Ditches 93-A and 93-B. Install one-half round invert tile. (LRD).

u. Drainage system No. 94.

(1) Ditch 94. Install one-half round invert tile. (LRD).

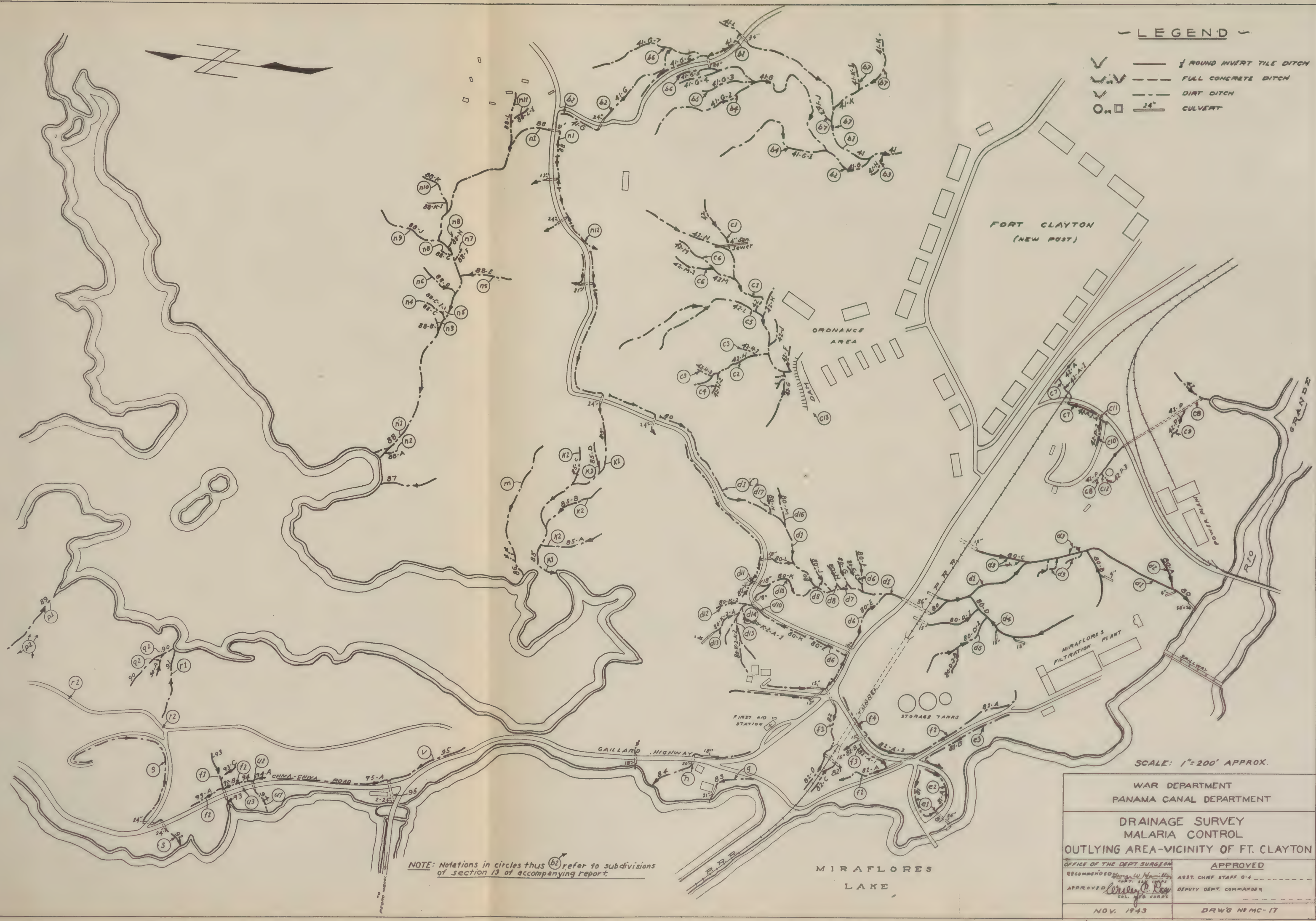
(2) Ditch 94-A. Install one-half round invert tile for 20 feet above junction with 94. (LRD).

(3) Fill extensive ruts in shoulders of Chiva Chiva Road in vicinity of ditch 94. (IN).

v. Drainage system No. 95.

Regrade upper section of ditch. (IN).





~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- 24" CULVERT

FORT CLAYTON  
(NEW POST)

ORDNANCE  
AREA

MIRAFLORES  
LAKE

SCALE: 1"=200' APPROX.

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
OUTLYING AREA-VICINITY OF FT. CLAYTON

OFFICE OF THE DEPT. SURGEON  
RECOMMENDED BY: [Signature]  
APPROVED: [Signature]  
NOV. 1943

APPROVED  
ASST. CHIEF STAFF G-4  
DEPUTY DEPT. COMMANDER  
DRWG NO MC-17

NOTE: Notations in circles thus (62) refer to subdivisions of section 13 of accompanying report.





Recommended George W. Hamilton  
Captain, Sanitary Corps.

Approved Wesley C. Cox  
Colonel, Medical Corps.

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_

Deputy Department Commander \_\_\_\_\_



MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

13 JANUARY 1944





14. SPECIFIC REPORT ON FORT WILLIAM D. DAVIS. (AREA NO.11).

a. Area included. Fort William D. Davis and vicinity as indicated on accompanying Maps M.C. 18 and M.C. 19.

b. Drainage System No. 96.

(1) Ditch 96. Pave invert and side slopes from junction with 96-A to 7' x 15' culvert just downstream from junction with 96-Q. Install one-half round invert tile from the 7' x 15' culvert to junction with 96-S. (LRD. Part Panama Canal and part Army). See subsequent report for system above junction with 96-S.

(2) Ditch 96-A. See subsequent report for this ditch and its tributaries.

(3) Ditch 96-B. Install one-half round invert tile. (Panama Canal property. NFD).

(4) Ditch 96-C. Install one-half round invert from junction with 96 to 100 feet above junction with 96-C-1. (NFD).

(5) Ditch 96-C-1. Install one-half round invert tile. (NFD).

(6) Ditch 96-D. Install one-half round invert tile from junction with 96 to a point 100 feet from end of system. (NFD).

(7) Ditches 96-E and 96-F. Install one-half round invert tile in each of these ditches from their junctions with 96 to 200 feet upstream from these junctions. (NFD).

(8) Ditch 96-G. Regrade for 20 feet above junction with 96. (NFD).

(9) Ditch 96-H and indicated tributaries. Install one-half round invert tile. (NFD).

(10) Ditch 96-J. Install one-half round invert tile from junction with 96 to 100 feet above 24" road culvert just above junction of 96-J with 96-J-1. Reset this 24" culvert if required to obtain grade for outlet to ditch 96. Regrade all of 96-J system to eliminate local pools of water. All of above (IN).

(11) Ditch 96-J-1. Install one-half round invert tile from junction with 96-J to the existing paved section in rear of motor pool. (IN).

(12) Ditch 96-K. Install one-half round invert tile for 50 feet upstream from junction with 96. (IN).

(13) Ditch 96-L. Pave invert side slopes from junction with 96 to junction with 96-L-1. (NFD). Recondition section from junction with 96-L-1 to junction with 96-L-4. (IN). Install one-half round invert tile for 50 feet above junction with 96-L-4. (IN).

(14) Ditch 96-L-3. Install one-half round invert tile from junction with 96-L to culvert outlet located about 300 feet from this junction. (IN).

(15) Ditch 96-M. Install approximately 100 feet of one-half round invert tile from junction with 96 to beginning of existing paved section. (IN). Repair side walls above this latter point. (IN).

(16) Ditch 96-M-1. Install one-half round invert tile for 80 feet above junction with 96-M. (IN).

(17) Ditch 96-N. Install one-half round invert tile, regrading area around end to drain into ditch. (NFD).

(18) Ditch 96-Q. Recondition invert and pave side walls from junction with 96 to junction with 96-Q-5. (NFD). Install one-half round invert tile from this latter point to end of system. (LRD).

(19) Ditch 96-Q-1. Install one-half round invert tile. (NFD).

(20) Ditches 96-Q-2 and 96-Q-3. Install one-half round invert tile. (IN).

(21) Ditch 96-Q-4. Repair side slopes from junction with 96-Q to end. (IN).

(22) Ditch 96-Q-4-A. Install one-half round invert tile. (IN).

(23) Ditch 96-Q-5. Install one-half round invert tile for 20 feet above junction with 96-Q. (IN).

(24) Ditch 96-Q-6. Install one-half round invert tile for 200 feet upstream from junction with 96-Q. (LRD).

(25) Ditch 96-R. Install one-half round invert tile from junction with 96 to junction with 96-R-1. (LRD). See subsequent report for system above this point.

c. Miscellaneous items in area tributary to Drainage System No. 96.

(1) Fill low local depressions in area bounded by ditches 96, 96-L, 96-L-4 and 96-P. (IN).



(2) Remove deteriorated and abandoned bridge from across ditch 96 at a point about 500 feet upstream from junction of this ditch with 96-Q. (IN).

(3) Fill large depression located on east side of ditch 96-R about 500 feet upstream from junction of this ditch with 96. (LRD).

d. Drainage System No. 97.

(1) Ditch 97.

(a) Pave invert and side slopes from 42' x 10' culvert under Boliver Highway to 7' x 9' culvert under the Panama Railroad just downstream from junction with 97-X. (LRD).

(b) Straighten and pave invert and side slopes from last mentioned culvert under railroad to 8' x 7½' culvert under railroad about 250 feet upstream from junction with 97-BB. (Panama Canal Property. NFD).

(c) Straighten and pave invert and side slopes from last mentioned 8' x 7½' culvert to junction with 97-DD. (NFD).

(d) Pave invert and side slopes from junction with 97-DD to 97-FF. (LRD).

(e) Install one-half round invert tile from junction with 97-FF to 97-JJ (LRD). See subsequent survey for system above this point.

(2) Ditch 97-A. Install one-half round invert tile. (IN).

(3) Ditch 97-B. Eliminate large erosion hole at junction with 97. Pave inlet and outlet to 2 - 24" culverts under Bolivar Highway. Install one-half round invert tile from these culverts to end of system. All of above, (IN).

(4) Ditch 97-B-1. Install one-half round invert tile for 50 feet above junction with 97-B. (IN).

(5) Ditch 97-B-2. Install one-half round invert tile. (IN).

(6) Ditch 97-D. Install one-half round invert tile. (IN).

(7) Ditch 97-D-1. Install one-half round invert tile resetting the 12" culvert, if required, and including the indicated tributary. (IN).

(8) Ditch 97-F. Pave invert and side slopes from junction with 97 to 19' x 6' culvert just downstream from junction with 97-F-8. (LRD). Pave invert and side slopes from golf course water hazard near junction with 97-F-16 to junction with 97-F-19. (LRD). Install one-half round invert tile from junction with 97-F-19 to end of water in ditch approximately 200 feet above junction with 97-F-20. (IN).

(9) Ditch 97-F-1. Connect into ditch 97 and recondition. (IN).

(10) Ditches 97-F-1-A, 97-F-2 and 97-F-3. Install one-half round invert tile in these ditches including the indicated tributaries. (IN).

(11) Ditch 97-F-4. Install one-half round invert tile in unpaved section for approximately 100 feet above junction with 97-F. (IN). Repair side walls where ditch passes under fence just above junction with 97-F-4-A. (IN). Install one-half round invert tile from junction with 97-F-4-C to end. (NFD).

(12) Ditches 97-F-4-A and 97-F-4-B. Install one-half round invert tile. (NFD).

(13) Ditch 97-F-4-B. Install one-half round invert tile in the two short feeds into this ditch from motor pool area. (NFD).

(14) Ditches 97-F-5 and 97-F-6. Install one-half round invert tile including indicated tributaries. (IN).

(15) Ditch 97-F-7. Install one-half round invert tile from junction with 97-F to a point 150 feet from end. (IN).

(16) Ditch 97-F-8. Install one-half round invert tile. (IN).

(17) Ditch 97-F-8-1. Install one-half round invert tile including the indicated tributaries. (IN).

(18) Ditch 97-F-9. Install one-half round invert tile. (IN).

(19) Ditch 97-F-10. Recondition throughout, completing unpaved section of about 6 feet at inlet to culvert under road. (IN).

(20) Ditch 97-F-11. Install one-half round invert tile. (IN).

(21) Ditch 97-F-12. Install one-half round invert tile from junction with 97-F to corner of Beer Garden. (IN).



(IN). (22) Ditch 97-F-13. Pave inlet to this culvert.

(23) Ditch 97-F-14. Straighten and pave invert and side slopes from junction with 97-F to junction with 97-F-14-E. (LRD). See subsequent report for system above this point and ditches 97-F-14-D and 97-F-14-E.

(24) Ditch 97-F-14-A. Install one-half round invert tile from junction with 97-F-14 to a point 200 feet above junction with 97-F-14-A-1. Recondition junction with 97-F-14-A-1. (IN).

(25) Ditch 97-F-14-B. Install one-half round invert tile from junction with 97-F-14 to beginning of existing paved section. (LRD).

(26) Ditch 97-F-14-C. Recondition throughout and pave side slopes to within 300 feet of end. Repair side walls for the upper 300 foot section. (IN).

(27) Ditches 97-F-15, 97-F-16, 97-F-17, 97-F-18 and 97-F-19. Install one-half round invert tile in unpaved sections of these ditches including the indicated tributaries. Recondition and/or replace paved sections. (IN).

(28) Ditches 97-G and 97-H. Install one-half round invert tile. (IN).

(29) Ditch 97-J. Install one-half round invert tile from junction with 97 to 18" culvert under Bolivar Highway. Pave inlet to 18" culvert. (IN).

(30) Ditch 97-J-1. Install one-half round invert tile. (IN).

(31) Ditch 97-K. Install one-half round invert tile. (IN).

(32) Ditches 97-L, 97-M, 97-N and 97-P. Regrade to eliminate local pooling of water. (IN). Install one-half round invert tile. (LRD).

(33) Ditch 97-Q. Complete junction with 97. Install one-half round invert tile for 100 feet upstream from culvert under Bolivar Highway. (IN).

(34) Ditch 97-Q-1. Install one-half round invert tile. (IN).

(35) Ditch 97-S. Regrade. (IN).

(IN). (36) Ditch 97-T. Pave invert and side slopes.



(37) Ditch 97-U. Install one-half round invert tile to a point 100 feet from end. Lower 6" culvert under Bolivar Highway, if required, to obtain outlet for this ditch. (IN).

(38) Ditch 97-U-1. Install one-half round invert tile. (IN).

(39) Ditch 97-V. Install one-half round invert tile in sections now unpaved to a point 200 feet from end. (IN). Recondition existing paved section. (IN).

(40) Ditch 97-V-1. Install one-half round invert tile for 50 feet upstream from junction with 97-V. (IN).

(41) Ditch 97-V-2. Clean 6" culvert in this ditch. (IN).

(42) Ditch 97-V-3. Install one-half round invert tile from junction with 97-V to outlet of 30" culvert. (IN).

(43) Ditch 97-V-4. Recondition this ditch throughout. (IN).

(44) Ditch 97-V-4-A. Regrade. (IN).

(45) Ditch 97-V-5. Install one-half round invert tile from junction with 97-V to outlet of culvert. (IN).

(46) Ditches 97-V-6, 97-V-7 and 97-V-8. Install one-half round invert tile. (IN).

(47) Ditch 97-V-9. Eliminate extensive erosion hole at junction of this ditch with 97-V. (IN).

(48) Ditch 97-W. Install one-half round invert tile from junction with 97 to 20 feet upstream from inlet to 15" culvert. (IN).

(49) Ditches 97-X, 97-Z and 97-AA. (Panama Canal property). See subsequent report for these ditches.

(50) Ditch 97-Y. Install one-half round invert tile. (Panama Canal property). (NFD).

(51) Ditch 97-BB. Install one-half round invert tile from junction with 97 to 36" culvert under railroad. (Panama Canal property). (NFD).

(52) Ditch 97-CC. Install one-half round invert tile from junction with 97 to junction with 97-CC-1. (NFD).

(53) Ditch 97-DD. Install one-half round invert tile from junction with 97 to within 200 feet of junction with 97-DD-6. (LRD).

(54) Ditch 97-EE. Install one-half round invert tile for 20 feet above junction with 97. (LRD).

(55) Ditch 97-FF. Install one-half round invert tile from junction with 97 to 300 feet upstream from junction with 97-FF-4. (LRD).

(56) Ditch 97-FF-4. Install one-half round invert tile for 50 feet upstream from junction with 97-FF. (LRD).

(57) Ditch 97-GG. Install one-half round invert tile from junction with 97 to end of water approximately 600 feet upstream from this junction.

(58) Ditch 97-HH. Install one-half round invert tile from junction with 97 to a point 50 feet upstream from culvert under railroad. (LRD).

e Miscellaneous items in area tributary to Drainage System No. 97.

(1) Drain extensive pool of water impounded by road to radio transmitter tower by installing 12" diameter culvert under road. (IN).

(2) Fill extensive ruts on both sides of ditch 97-C. (IN).

(3) Fill extensive ruts on west side of Bolivar Highway about 500 feet southwest of junction of ditches 97-B and 97-B-2. (IN).

(4) Fill hole located about 200 feet north-east of junction of ditches 97 and 97-D. (IN).

(5) Fill local depressions in area between Bolivar Highway and ditch 97 from ditch junctions 97 with 97-F to 97 with 97-T. (IN).

(6) Fill local depressions in area between Panama Railroad and Bolivar Highway from end of ditch 97-Q-1 to end of ditch 97-U. (IN).

(7) Provide roof drainage system for guard house. (LRD).

(8) Eliminate pot hole at junction of sewer entering ditch 97 between junctions of this ditch with 97-T and 97-V. (IN).



(9) Extend ditch 97-F-6 with one-half round invert tile to drain low area near end of this ditch. (IN).

(10) Eliminate pot hole at ditch entering ditch 97-F at a point about 250 feet upstream from junction of 97-F and 97-F-4. (IN).

(11) Fill areas located at points about 200 feet northwest of and 200 feet southwest of junction of ditch 97-F-4 and 97-F-4-B. (IN).

(12) Fill extensive local depressions in area located between Post Chapel and ditch 97-F-4. (IN).

(13) Drain seepage area located about 300 feet northwest of junction of 97-F and 97-F-13. (IN).

(14) Eliminate pot hole located in south bank of ditch 97-F-14 at a point about 600 feet upstream from junction of 97-F and 97-F-14. (IN).

(15) Fill depression in north bank of ditch 97-F-14-A at a point about 300 feet upstream from junction of this ditch with 97-F-14. (IN).

(16) Recondition roof drainage system around building located in V between ditches 97-F-14-A and 97-F-14. (IN).

(17) Eliminate large pot hole in east bank of ditch 97-F-14-C at a point about 150 feet upstream from junction of this ditch with 97-F-14. (IN).

(18) Fill extensive local depressions in area located in V formed by ditch 97-F at junction with 97-F-14. Install one-half round invert tile drain for area west of junction of 97-F and 97-F-15. (IN).

(19) Improve upper end of golf water hazard pool at junction of 97-F and 97-F-16 by adding concrete walls. (LRD).

(20) Regrade area located in V between ditches 97-F and 97-F-15. (IN).

(21) Fill area located about 250 feet south of junction of ditches 97-F and 97-F-15. (IN).

(22) Fill and regrade area around ditches 97-F-17, 97-F-18 and 97-F-19 to drain into these ditches. (IN).

(23) Fill hole on north bank of ditch 97-F at a point about 250 feet downstream from junction of this ditch with ditch 97-F-20. (IN).



(24) Extend ditch 97-V-4-B with laterals as required to drain extensive ground water outcrop located near end of this existing ditch. Install one-half round invert tile in entire system. (IN).

(25) Install one-half round invert tile in ditch at rear of field officers' quarters. (LRD).

(26) Drain swamp located on east side of ditch 97-Y by one-half round invert tile laterals into ditch 97-Y. (Panama Canal property). (NFD).

(27) Drain swamp located about 100 feet southwest of outlet of 36" culvert under railroad in ditch 97-BB by one-half round invert tile lateral into this ditch. (Panama Canal property). (NFD).

(28) Fill large hole on east side of Panama Railroad at a point about 200 feet west of junction of ditches 97 and 97-E. (Panama Canal property). (IN).

f. Drainage System No. 98.

(1) Ditch 98. See subsequent report for recommendations this ditch.

(2) Ditch 98-N. Install one-half round invert tile from junction with 98 to a point 40 feet upstream from junction with 98-N-2. (NFD).

(3) Ditch 98-N-1. Install one-half round invert tile. (NFD).

(4) Ditch 98-N-2. Install one-half round invert tile for 10 feet upstream from junction with 98-N. (NFD).

g. Drainage System No. 99. System is in possible influence area of Third Locks Project and all recommendations made herein should be coordinated with plans for that project.

(1) Ditch 99-A. Install one-half round invert tile from junction with 99-A-1 to junction with 99-A-5. (Panama Canal property). (LRD).

(2) Fill and drain or provide positive salt water circulation to large swamp located on both sides of ditch 99. (Panama Canal property). (LRD).

(3) Fill ruts and minor depressions in area between Panama Canal and newly located Panama Railroad for the section north of the Gatun - Fort Davis Highway. (Panama Canal Property). (IN).

h. Drainage System No. 100. System is in possible influence area of Third Locks Project and all recommendations made herein should be coordinated with plans for that project.

(1) Ditch 100. Recondition side walls of lower section, if it is not to be affected by lock excavation. Pave invert and side slopes or otherwise incorporate in final Third Locks Project Plans the section of ditch above junction with 100-G. Overflow from flooded excavated section is now pouring into ditch through 100-G, resulting in practical stagnation of ditch 100 above junction with 100-G. (Panama Canal property). (LRD). Continue oiling this section of ditch or as alternate, the overflow point from flooded section might be moved upstream as far as practicable to produce current in ditch. (Panama Canal property). (IN).

(2) Ditch 100-A. Install one-half round invert tile. (Panama Canal property). (LRD).

(3) Ditch 100-C and 100-C-1. Install one-half round invert tile, regrading area at upper end of ditch 100-C to drain into it. (Panama Canal property). (LRD).

(4) Ditch 100-E. Install one-half round invert tile from junction with ditch 100 to 400 feet above junction with 100-E-1. (Panama Canal property).

(5) Ditch 100-E-1. Install one-half round invert tile from junction with 100-E to culver under highway. (Panama Canal property). (LRD).

(6) Ditch 100-F. Install one-half round invert tile. (Panama Canal property). (LRD).

(7) Fill low areas and install one-half round invert tile as required to completely drain area bounded by Panama Canal, ditches 100 and 101 and Gatun - Fort Davis Highway. (Panama Canal property). (LRD).

(8) Fill ruts and drain seepage areas in areas between ditch 100 and Gatun-Fort Davis Highway in vicinity of junction of ditches 100 and 100-G. (Panama Canal property). (IN).

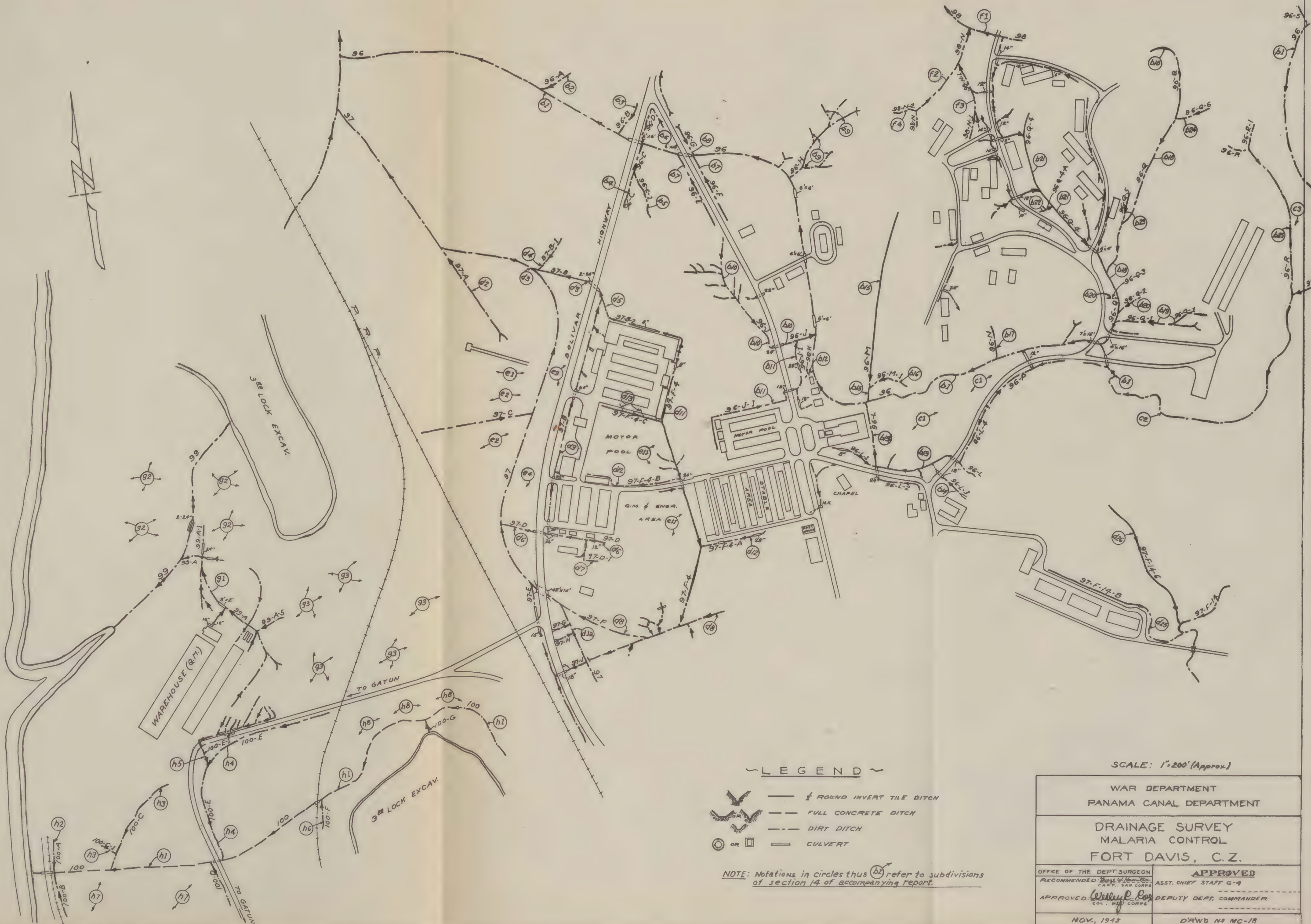
k. Drainage System No. 101. System is in possible influence area of Third Locks Project and all recommendations made herein should be coordinated with plans for that project.

(1) Ditch 101-C. Install one-half round invert tile with subsurface drains into extensive seepage areas on both sides and at end of this ditch. (Panama Canal property). (LRD).

(2) Drain area which is impounding water and which is located about 400 feet south of junction of ditches 101 and 101-C. (Panama Canal property). (LRD).



PANAMA CANAL



~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

NOTE: Notations in circles thus (92) refer to subdivisions of section 14 of accompanying report.

SCALE: 1"=200' (Approx.)

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
FORT DAVIS, C.Z.

OFFICE OF THE DEPT. SURGEON RECOMMENDED: <i>W. P. Roy</i> CAPT. SAN CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
NOV, 1945	DRAWN BY MC-18











Recommended George W. Hamilton  
Captain, Sanitary Corps.

Approved \_\_\_\_\_  
Colonel, Medical Corps.

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_

Deputy Department Commander \_\_\_\_\_



MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

13 JANUARY 1944





15. SPECIFIC REPORT ON FORT RANDOLPH AND VICINITY.  
AREA NO. 12 ).

a. Area included. Fort Randolph and vicinity as indicated on accompanying map M.C. 20.

b. Drainage System No. 102.

(1) Ditch 102. Install one-half round invert tile from junction with 102-A to 150 feet upstream from culvert under new road to battery. Regrade and fill area above this culvert so that it will completely drain. (IN).

(2) Ditch 102-A. Regrade. (IN).

c. Drainage System No. 103.

(1) Ditch 103. Install one-half round invert tile from a point 50 feet upstream from junction with 103-A to 24" culvert under access road. (NFD).

(2) Regrade area south of ditch 103-A. (IN).

d. Drainage System No. 104.

(1) Ditch 104. Install one-half round invert tile from junction with 104-A to end of ditch. (NFD).

(2) Ditch 104-B. Install one-half round invert tile from junction with 104 to junction with 104-B-1. (NFD).

(3) Ditch 104-C. Install one-half round invert tile for 100 feet upstream from junction with 104. (NFD).

(4) Fill ruts in area located about 200 feet northwest of junction of 104 and 104-C. (IN).

e. Drainage System No. 105.

(1) Ditches 105-A, 105-A-1 and 105-A-2. Install one-half round invert tile. (NFD).

(2) Fill or regrade several garden ditches between ditches 105 and 105-A-1. (IN).

(3) Fill holes on north side of ditch 105 at entrance to baseball grandstand. (IN).

(4) Fill holes at end of ditch 105. (IN).

f. Drainage System No. 106.

(1) Ditch 106-B. Install one-half round invert tile. (LRD).

(2) Replace 6" culvert located in ditch 106 just upstream from junction with 106-D. (NFD).

g. Drainage System No. 107.

(1) Ditch 107. Install one-half round invert tile from a point 100 feet downstream from outlet of 24" culvert just below junction of 107 and 107-C to end of system. (IN).

(2) Ditch 107-B. Install one-half round invert tile from junction with 107 to outlet of 18" culvert under road. (IN).

(3) Ditch 107-C. Install one-half round invert tile from junction with 107 to 20" culvert under road. (IN).

h. Drainage System No. 108.

(1) Ditch 108. Install one-half round invert tile from junction with 108-A to end of system. (IN).

(2) Ditch 108-A. Install one-half round invert tile from junction with 108 to junction with 108-A-1. Regrade remainder of system. (IN).

(3) Ditch 108-B. Install one-half round invert tile. (IN).

k. Drainage System No. 109.

(1) Ditch 109. Recondition section immediately upstream from junction with 109-C. (IN). Install approximately 200 feet of one-half round invert tile for section immediately upstream from junction with 109-E. (IN). Regrade section immediately upstream from junction with 109-F. (IN).

(2) Ditch 109-B. Install one-half round invert tile from a point 100 feet upstream from junction with 109 to end of system. (IN).

(3) Ditch 109-B-1. Eliminate erosion hole at junction of this ditch with 109-B. (IN).

(4) Ditch 109-B-2. Install one-half round invert tile including all of the indicated tributaries. (IN).

(5) Ditch 109-C. Install one-half round invert tile from junction with 109 to next 20" culvert upstream from this point. (IN).

(6) Ditch 109-D. Install one-half round invert tile including all of the indicated tributaries. (IN).

(7) Ditches 109-E, 109-E-1 and 109-E-2. Install one-half round invert tile. (IN).



invert tile. (IN). (8) Ditch 109-F. Install one-half round

feet west of junction of ditches 109-B and 109-B-2. (IN).

(10) Regrade area located between ditch 109 and NCO quarters. (IN).

(11) Fill extensive ruts located near end of ditch 109-E. (IN).

m. Drainage System No. 110.

Ditch 110. Clean and recondition entire system and adjacent area so that positive salt water circulation is effected. (NFD).

n. Drainage System No. 111.

(1) Ditch 111. Clean and recondition entire system so that positive salt water circulation is effected. (NFD).

(2) Fill hole and trench located about 100 feet southwest of outlet of ditch 111. (NFD).

p. Drainage System No. 112.

(1) Ditch 112. Recondition end of ditch. (IN).

(2) Ditches 112-A, 112-B, 112-C, 112-D, 112-E, 112-F and 112-G. Install one-half round invert tile in these ditches including the indicated tributaries. (IN).

(3) Ditch 112-H. Install one-half round invert tile from junction with 112 to junction with 112-H-1. (IN).

(4) Ditch 112-H-1. Install one-half round invert tile from junction with 112-H to a point 40 feet upstream from this junction. (IN).

q. Drainage System No. 113.

Ditch 113. Recondition end of ditch. (IN).

r. Drainage System No. 114.

Ditch 114. Install 60 feet of one-half round invert tile at the end of ditch. (IN).

s. Miscellaneous improvements.

(1) Fill extensive holes and depressions in area located about 200 feet south of ditch 112-H. (IN).

(2) Regrade area located about 150 feet south of ditch 109-B. (IN)

(3) Drain and/or fill depression located about 250 feet northwest of junction of ditches 112 and 112-A. (IN).

(4) Install 30 feet of one-half round invert tile in section of unpaved ditch located about 200 feet west of post theater. (IN).

Recommended \_\_\_\_\_  
Captain, Sanitary Corps.

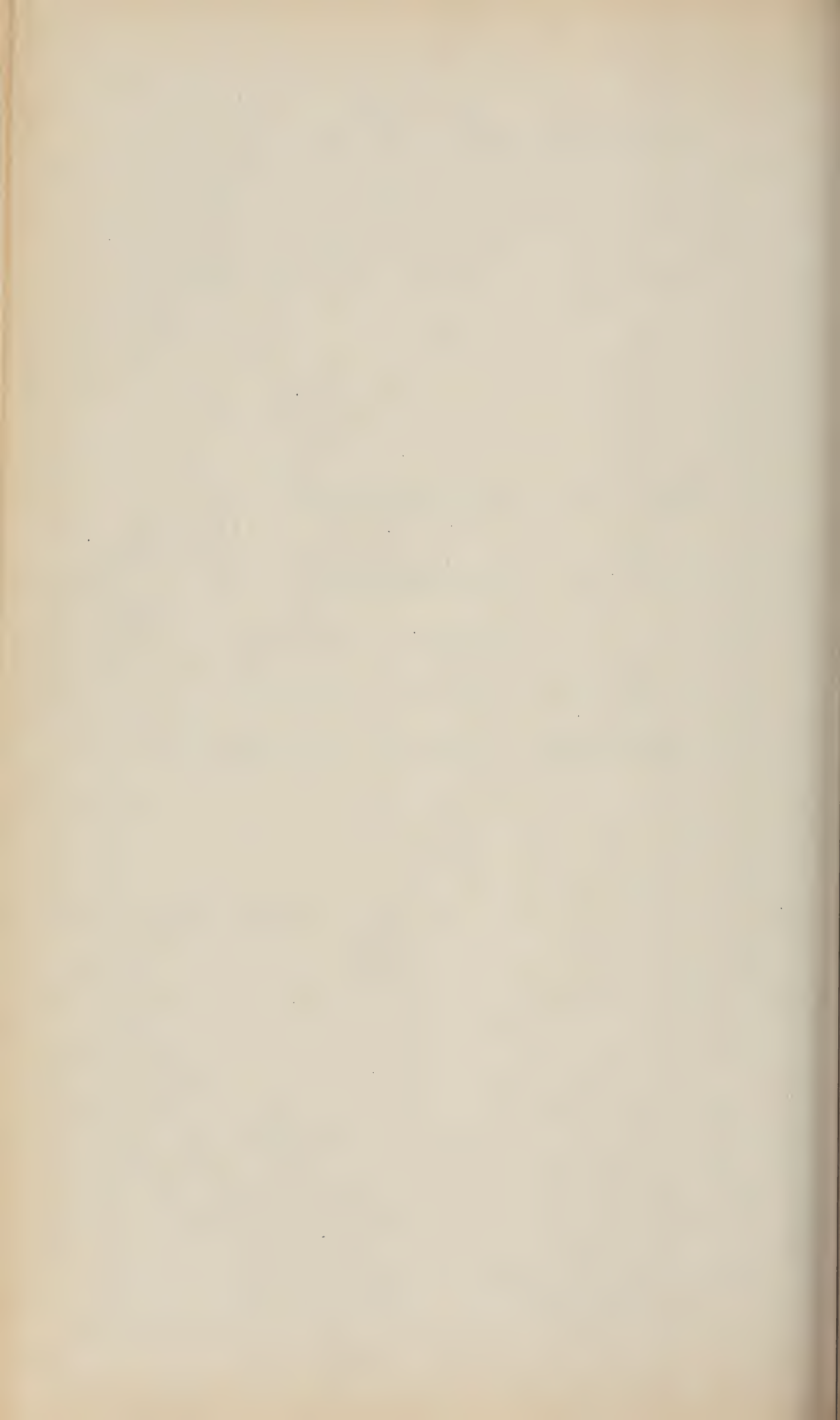
Approved \_\_\_\_\_  
Colonel, Medical Corps.

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_

Deputy Department Commander \_\_\_\_\_







MARGARITA  
BAY

— LEGEND —

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

NOTE: Notations in circles thus, 62 refer to subdivisions of section 15 of accompanying report.

SCALE: 1"=200' (Approx.)

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL FORT RANDOLPH, C.Z.	
OFFICE OF THE DEPT. SURGEON RECOMMENDED: <i>George S. Hamilton</i> CAPT., U.S. ARMY	APPROVED ASST. CHIEF STAFF S-4: DEPUTY DEPT. COMMANDER
APPROVED: <i>Walter P. Box</i> COL., U.S. ARMY	DEC. 1943
DRAWG NO MC-20	





MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

MARCH 1944



16. SPECIFIC REPORT ON FORT GULICK AND VICINITY.  
(AREA NO. 13).

a. Area included. Fort Gulick and vicinity as indicated on accompanying Maps M.C. 21 and M.C. 22.

b. Drainage System No. 115.

(1) Ditch 115. Pave invert and side slopes from 6' diameter culvert under Bolivar Highway to junction with 115-X. (LRD). Install 1/2 round invert tile from junction with 115-X to a point 400' upstream from this junction (LRD). (Part Panama Canal property and part Army).

(2) Ditch 115-A. Remove 24" culvert in this ditch at U.S. Navy Oil pipe line crossing. This culvert is inadequate in size and has been set with its flow line elevation approximately 15 inches above the flow line of the existing paved ditch. These conditions have contributed to the silting up of the entire system above this 24" culvert. Clean ditch and recondition side walls from this 24" culvert to the 30" culvert just upstream from junction with 115-A-5. (All of above (IN) and Panama Canal property).

(3) Ditch 115-A-1. Install 1/2 round invert tile. (Panama Canal property LRD).

(4) Ditch 115-A-2. Install 1/2 round invert tile in upper section of this ditch filling low area East of this ditch as required to drain into ditch. (Panama Canal property LRD.) Clean paved section of ditch 115-A-2 including the indicated tributaries. (IN).

(5) Ditch 115-A-3. Install 1/2 round invert tile from junction with 115-A to junction with 115-A-3-A. (Panama Canal property LRD.)

(6) Ditch 115-B. Open ditch at U.S. Navy oil pipe line crossing where ditch is totally obstructed, impounding stagnant water for several hundred feet upstream from this point. (Panama Canal property. IN) Install 1/2 round invert tile from junction with 115 to 24" culvert at junction with 115-B-1. (NFD)

(7) Ditch 115-C. Pave invert from junction with 115 to junction with 115-C-3. (Panama Canal Property. NFD)/

(8) Ditches 115-C-1 and 115-C-2. Install 1/2 round invert tile. (Panama Canal Property NFD).

(9) Ditch 115-D. Pave invert and side slopes from junction with 115 to junction with 115-D-1. Install 1/2 round invert tile from this point to end of system. (Panama Canal property. IN).



- (10) Ditch 115-D-1. Install 1/2 round invert tile. (Panama Canal property. IN).
- (11) Ditch 115-E. Install 1/2 round invert tile. (Panama Canal property. LRD)
- (12) Ditch 115-F. Pave invert and side slopes. (Panama Canal property. IN)
- (13) Ditches 115-F-1 and 115-F-2. Install 1/2 round invert tile in each ditch for 150 feet upstream from junctions with 115-F. (Panama Canal property IN).
- (14) Ditches 115-G and 115-G-1. Install 1/2 round invert tile. (Panama Canal property IN).
- (15) Ditches 115-H and 115-H-1-A. Install 1/2 round invert tile. (Panama Canal property IN).
- (16) Ditch 115-H-1. Install 1/2 round invert tile from junction with 115-H to a point 50 feet upstream from junction with 115-H-1-A. (Panama Canal property IN).
- (17) Ditch 115-J. Pave invert and side slopes from junction with 115 to junction with 115-J-4. (Part Panama Canal and part Army property IN).
- (18) Ditches 115-J-2 and 115-J-3. Install 1/2 round invert tile. (IN)
- (19) Ditch 115-K. Install 1/2 round invert tile. (IN)
- (20) Ditch 115-L. Regrade section from junction with 115 to culvert under access highway (IN). Pave invert and side slopes (LRD).
- (21) Ditch 115-M. Pave invert and side slopes from junction with 115 to end of system (IN).
- (22) Ditch 115-M-1. Install 1/2 round invert tile from junction with 115-M to junction with 115-M-1-B. (IN).
- (23) Ditch 115-M-1-A. Install 1/2 round invert tile (IN).
- (24) Ditch 115-M-2. Install 1/2 round invert tile from junction with 115-M to junction with 115-M-2-A. (IN).
- (25) Ditch 115-M-3. Install 1/2 round invert tile (IN).
- (26) Ditch 115-M-4. Install 1/2 round invert tile (LRD).

(27) Ditches 115-N and 115-N-1. Install 1/2 round invert tile. (IN).

(28) Ditch 115-P. Install 1/2 round invert tile for 150 feet above junction with 115. (IN)

(29) Ditches 115-Q and 115-R. Install 1/2 round invert tile. (IN).

(30) Ditch 115-S. Install 1/2 round invert tile for 250 feet upstream from junction with 115. (IN).

(31) Ditch 115-U. Install 1/2 round invert tile from junction with 15 to a point 100 feet upstream from junction with 115-U-2. (IN)

(32) Ditch 115-U-1. Install 1/2 round invert tile for 60 feet upstream from junction with 115-U. (IN)

(33) Ditch 115-U-2. Install 1/2 round invert tile. (IN)

(34) Ditch 115-V. Install 1/2 round invert tile from junction with 115 to a point 50 feet upstream from the 12" culvert located about opposite the midpoint of the post laundry. (IN)

(35) Ditch 115-W. Install 1/2 round invert tile from junction with \*\* 5 to a point 150 feet upstream from junction with 115-W-1. (IN)

(36) Ditch 115-W-1. Install 1/2 round invert tile. (IN)

(37) Ditch 115-X. Install 1/2 round invert tile from junction with \*\*\* to a point 400 feet upstream from this junction. (IN)

c. Drainage System No. 116.

(1) Ditch 116.

(a) See subsequent report for section below junction with 116-E.

(b) Improve channel from junction with 116-E to junction with 116-Q removing fallen trees and other debris. Avoid the destruction of shade. (Part Panama Canal and part Army property. IN)

(c) Pave invert and side slopes from junction with 116-E to 116-Q. (Part Panama Canal and part Army property. LRD).

\*\*Illegible



(d) Pave invert and side slopes from junction with 116-Q to 116-V, regrading areas on each side of ditch to drain into it. (IN)

(c) Improve channel which is predominantly reasonably smooth rock outcrop from junction with 116-V to a point 200 feet upstream from junction with 116-Z. This is to be accomplished by a combination of regrading, filling depressions with lean concrete and installing 1/2 round invert tile or paved sections for parts where rock outcrop does not form a naturally paved channel. (LRD). Install 1/2 round invert tile for section above 8" culvert and paralleling magazine area road. (LRD)

(2) Ditch 116-E. Pave invert from junction with 116 to a point 600 feet above this junction. (Panama Canal property. LRD)

(3) Ditch 116-F. See subsequent report for this ditch.

(4) Ditch 116-G. Install 1/2 round invert tile with laterals as required to completely dry up marshy areas on each side of this ditch. (Panama Canal property. LRD).

(5) Ditch 116-H. Pave invert from junction with 116 to 116-H-2. Improve channel from junction with 116-H-2 to junction with 116-H-5 in the manner suggested under section 16-C-1-e. (Panama Canal property LRD). See subsequent report for ditch upstream from junction with 116-H-5.

(6) Ditch 116-H-1. Improve channel from junction with 116-H to end of system in the manner suggested under Section 16-C-1-e. (Panama Canal property LRD)

(7) Ditches 116-H-2 and 116-H-4. See subsequent report for these ditches.

(8) Ditches 116-H-3 and 116-H-5. Improve channels of these ditches in the manner suggested under Section 16-C-1-e. (Panama Canal property LRD).

(9) Ditch 116-J. Install 1/2 round invert tile from junction with 116 to junction with 116-J-2. Improve channel above junction with 116-J-2 in the manner suggested under Section 16-C-1-e. (Panama Canal property LRD).

(10) Ditches 116-J-1, 116-J-2 and 116-J-3. Install 1/2 round invert tile in each of these ditches. (Panama Canal property LRD).

(11) Ditches 116-K, 116-L, 116-M, 116-N and 116-P. Install 1/2 round invert tile. (LRD)

(12) Ditch 116-Q. Pave invert and side slopes from junction with 116 to 10 feet upstream from 18" culvert under highway. Find source of and connect outcrop of sanitary sewage located about 100 feet southwest of this 18" culvert into ditch 116-Q with a closed sewer. (IN).



(13) Ditch 116-R. Pave invert and side walls from junction with 116 to junction with 116-R-1. Install 1/2 round invert tile in remainder of ditch. (IN)

(14) Ditch 116-R-1. Pave invert and side slopes. (IN)

(15) Ditch 116-S. Install 1/2 round invert tile. (IN).

(16) Ditches 116-T, 116-T-1, 116-T-2, 116-T-3, 116-T-4 and 116-T-5. Improve channels of these streams in accordance with method suggested in Section 16-C-1-e. (LRD)

(17) Ditch 116-U. Install sub-surface drain packed in large rock or pave invert and side slopes. (IN)

(18) Ditch 116-V. Install sub-surface drain and/or pave invert. Eliminate seepage area on south bank of ditch just upstream from junction with 116-V-2 by the use of 1/2 round invert tile and sub-surface drains. (IN)

(19) Ditch 116-V-1. Improve channel in manner suggested in section 16-C-1-e. Include all of the indicated tributaries. (LRD)

(20) Ditch 116-V-2. Pave invert and side slopes and/or install sub-surface drain packed in large rock. (IN)

(21) Ditches 116-W, 116-X, 116-Y, 116-Z and 116-ZZ. Improve channels by method suggested in section 16-C-1-e. (LRD)

d. Drainage System No. 117.

(1) Ditch 117. Install 1/2 round invert tile in upper 150 feet of this ditch. (IN)

e. Drainage System No. 118.

(1) Ditch 118. Install 1/2 round invert tile in sections of this ditch where bottom is not naturally paved by rock outcrop. In sections where rock is outcropping smooth profile by filling depressions with lean concrete. (IN)

f. Drainage System No. 119.

(1) Ditch 119. Install 1/2 round invert tile from a point 100 feet upstream from Gatun Lake to a point 150 feet upstream from junction with 119-B. (IN)

(2) Ditch 119-B. Install 1/2 round invert tile from junction with 119 to junction with 119-B-1. (IN)

g. Drainage System No. 120.

(1) Ditch 120. Install 1/2 round invert tile from a point about 200 feet upstream from junction with 120-C which point is approximately the elevation of the East Diversion Channel water level to end of system. (Panama Canal property LRD).

(2) Ditch 120-C. Install 1/2 round invert tile from a point about 100 feet upstream from junction with 120 to junction with 120-C-1. (Panama Canal property LRD)

H. Drainage System No. 121.

(1) Ditch 121. Pave invert and side slopes from a point about 500 feet upstream from junction with 121-A, which point is the East Diversion Channel water level, to junction with 121-F. See subsequent report for recommendations above this point. (Panama Canal property LRD).

(2) Ditch 121-B. Pave invert from junction with 121 to junction with 121-B-1. See subsequent report for recommendations above this point. (Panama Canal property LRD).

(3) Ditch 121-B-1. Pave invert from junction with 121-B to end of system. (Panama Canal property LRD).

(4) Ditch 121-B-1-A. Install 1/2 round invert tile. (Panama Canal property LRD).

(5) Ditch 121-B-1-B. Install 1/2 round invert tile from junction with 121-B-1 to the next 18"  $\emptyset$  culvert under road. (Panama Canal property LRD)

(6) Ditch 121-C. Install 1/2 round invert tile from junction with 121 to end of system. (Panama Canal property LRD)

(7) Ditch 121-D. Install 1/2 round invert tile. (Panama Canal property LRD)

(8) Ditch 121-D-1. Fill this ditch which is a dead end of an abandoned channel. (Panama Canal property LRD).

(9) Ditch 121-E. Install 1/2 round invert tile from junction with 121 to the 36" culvert indicated. (Panama Canal property LRD).

(10) Ditch 121-F. Install 1/2 round invert tile from junction with 121 to end of ditch. (Panama Canal property LRD).

(11) Fill all of the abandoned ditch channels from which the normal watershed has been diverted for the section of Ditch 121 between the indicated earth dike and junction with 121-F. (Panama Canal property LRD).

(12) Ditch 121-H. See subsequent report for system downstream from junction with 121-H-12. From junction with 121-H-12 to junction with 121-H-15, improve stream by the installation of paved sections, by sub-surface drains packed in rock, or by filling depressions in ditch bottom with lean concrete where rock outcrop can be utilized as a naturally paved ditch. (LRD)

(13) Ditch 121-H-12. Pave invert from junction with 121-H to junction with 121-H-12-D. (LRD)

(14) Ditch 121-H-12-A. Install 1/2 round invert tile. (LRD).

(15) Ditch 121-H-13. Pave invert from junction with 121-H to end of system. (LRD).

(16) Ditch 121-H-13-A. Pave invert from junction with 121-H-13 to a point 400 feet upstream from this junction. (LRD)

(17) Ditch 121-X. See subsequent report for system downstream from junction with 121-X-12. Improve channel from junction with 121-X-12 to junction with 121-X-14 by installing paved sections, sub-surface drains packed in rock, or converting rock outcrop into a smoothly paved channel by filling depressions with lean concrete. (LRD).

(18) Ditches 121-X-12 and 121-X-12-A. Install paved sections, sub-surface drains packed in rock or convert rock outcrop into a smoothly paved channel by filling depressions with lean concrete. (LRD)





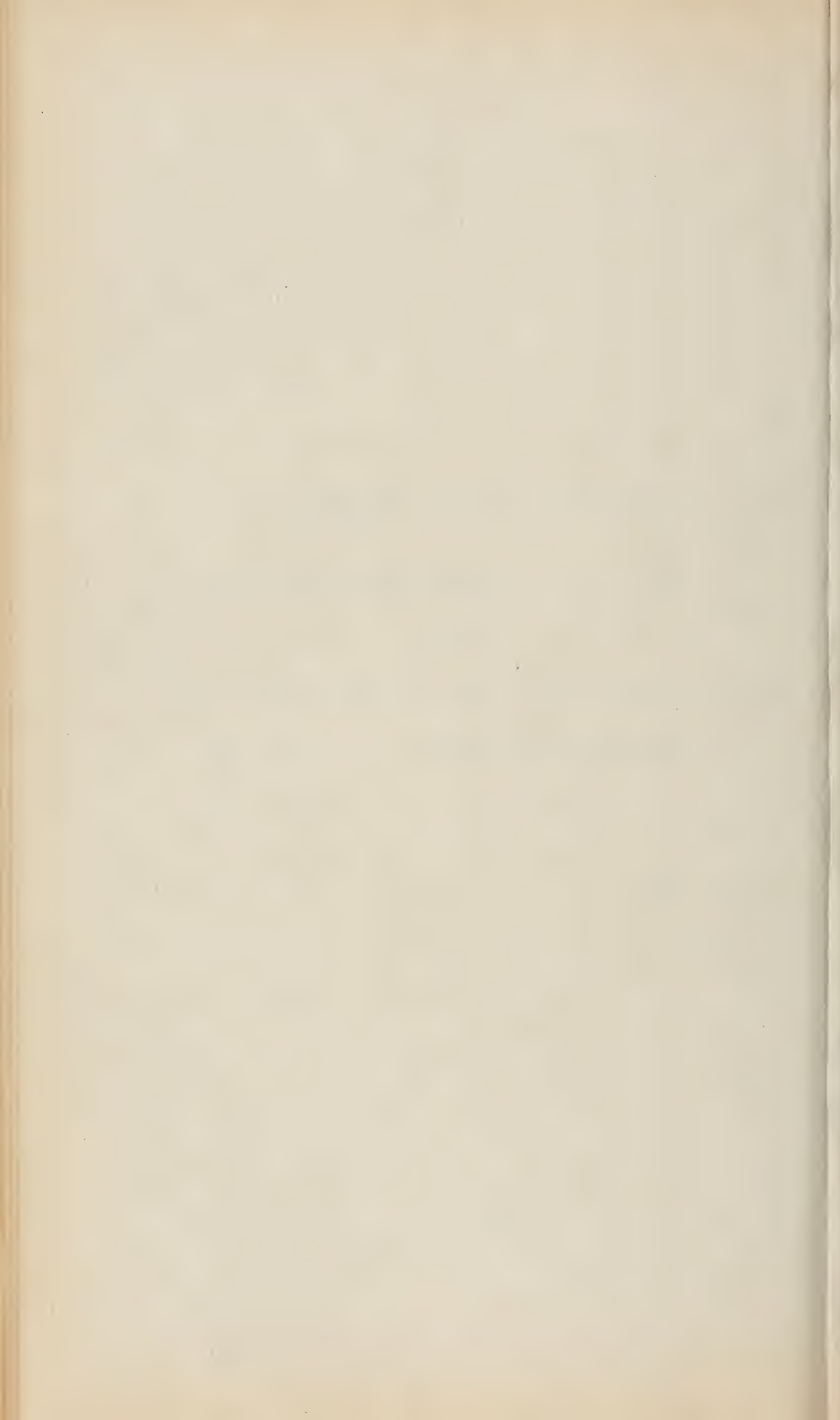
Recommended \_\_\_\_\_  
Captain, Sanitary Corps

Approved \_\_\_\_\_  
Colonel, Medical Corps.

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_

Deputy Department Commander \_\_\_\_\_



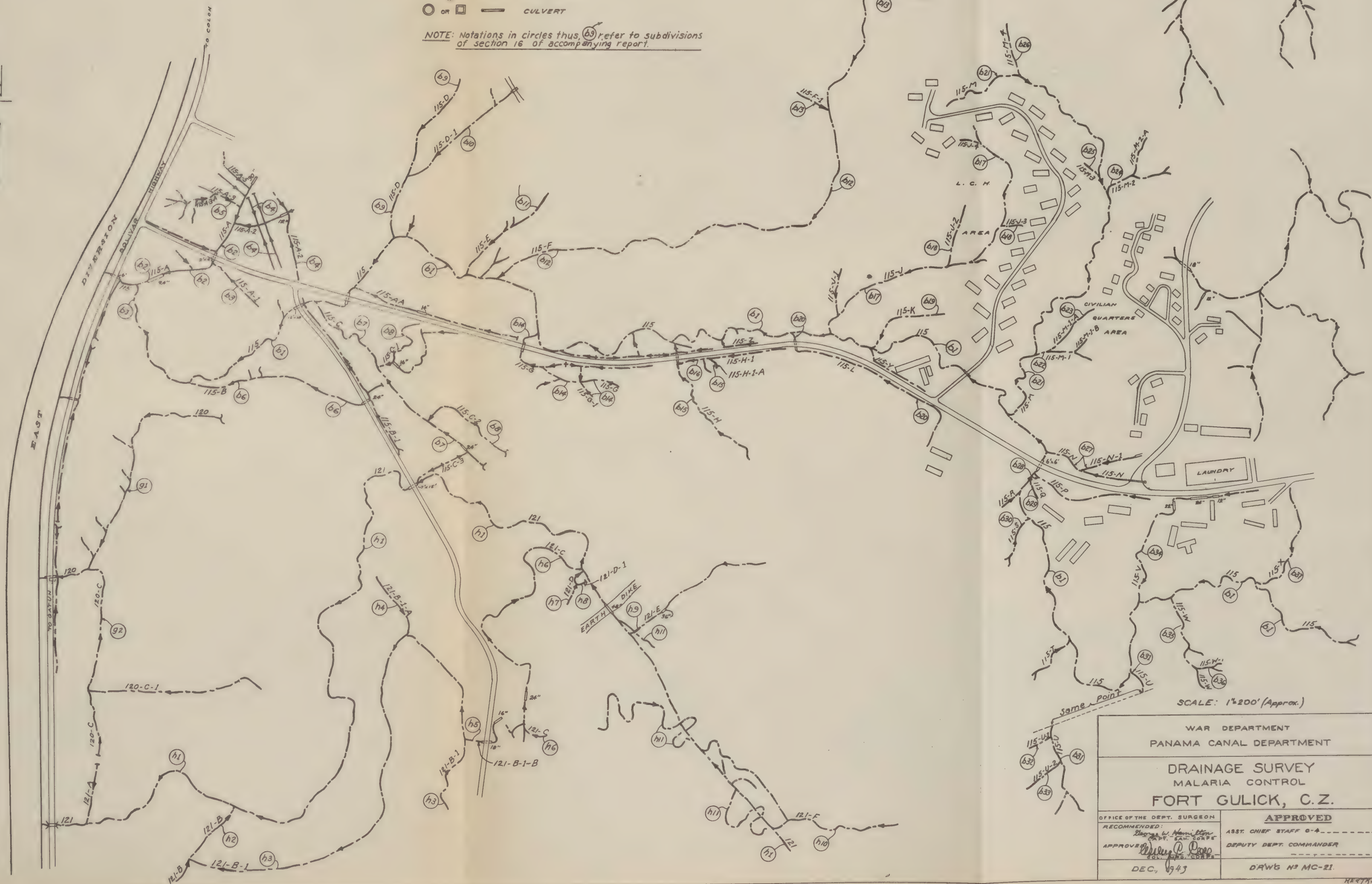




~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

NOTE: Notations in circles thus, (b3) refer to subdivisions of section 16 of accompanying report.



SCALE: 1"=200' (Approx.)

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL FORT GULICK, C.Z.	
OFFICE OF THE DEPT. SURGEON RECOMMENDED: APPROVED:	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
DEC, 1943	DRAWN BY MC-21.

HERTYE







WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL FORT GULICK, C.Z.	
OFFICE OF THE DEPARTMENT SURGEON RECOMMENDED <i>George W. Hamilton</i> CAPT. SAN. CORPS	APPROVED <i>Wm. B. Cox</i> COL. INF. CORPS
ASST. CHIEF STAFF B-4	DEPUTY DEPT. COMMANDER
DEC. 1945	DRWG NO MC-22.





MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

APRIL 1944





17. SPECIFIC REPORT ON FRANCE FIELD ( AREA NO. 14)

a. Area included. France Field and vicinity as indicated on accompanying maps M.C. 23, M.C. 24, M.C. 25 and M.C. 26.

b. Drainage System No. 122.

(1) Ditch 122. Straighten and pave invert and side slopes from junction with 122-J to junction with 122-T (LRD). Pave invert and side slopes from junction with 122-T to outlet of next 2 - 24" culverts (IN).

(2) Ditches 122-A and 122-B. Install 1/2 round invert tile. (IN).

(3) Fill depressions located in area between ditch 122-B and highway to Ft. Randolph (IN).

(4) Fill or open to permit access for salt water, the area located about 700 feet south of point where ditch 122 discharges into bay (IN).

(5) Ditch 122-D. Regrade ditch from junction with 122-D-7 to a point 200 feet upstream from this junction (IN). Install 1/2 round invert tile from junction with 122-D-8 to end of system (LRD). Regrade and fill area on both sides of ditch near upper end to eliminate extensive pooling of stagnant water (IN).

(6) Ditch 122-J. Install 1/2 round invert tile from junction with 122 to the point where existing ditch is paved (IN).

(7) Ditches 122-J-1 and 122-J-1-A. Install 1/2 round invert tile. (IN)

(8) Ditch 122-J-1-B. Open the outlet of this ditch so that it will drain into 122-J-1 (IN).

(9) Ditch 122-J-2. Install 1/2 round invert tile (LRD).

(10) Ditch 122-J-3. Install 1/2 round invert tile from junction with 122-J to junction with 122-J-3-A (LRD).

(11) Regrade area between barracks area and ditch 122-J and complete 1/2 round invert tile ditches from these barracks (IN).

(12) Ditches 122-L, 122-M and 122-N Install 1/2 round invert tile (LRD).

(13) Ditch 122-P. Pave invert and side slopes from junction with 122 to a point 200 feet downstream from 24" culvert from taxiway area (LRD). Pave invert and side slopes from this latter 200 foot point to the 24" culvert (IN).

(14) Ditches 122-P-2, 122-P-3, 122-S and 122-T.  
Install 1/2 round invert tile (LRD).

(15) Regrade area located about 300 feet north-east of the end of ditch 122-D (IN).

(16) Regrade areas around inlet boxes west of the north end of the N-S runway. Repair inverts of these inlets so that they will not retain water (IN)

c. Drainage System No. 123.

(1) Ditch 123.

(a) Straighten and pave invert and side slopes from junction with 123-J to the culverts under the Trans-Isthmian Highway (Part Panama Canal and part Army property. (LRD). See subsequent report for system upstream from these culverts.

(b) Install new culvert under south end of N-S runway, setting invert elevation approximately 3.5 feet lower than existing 5 foot diameter culvert to permit complete drainage of streams and area upstream from existing culvert (IN).

(c) Install 1/2 round invert tile in all of the unpaved ditches indicated as tributaries to ditch 123 between junctions of 123-P with 123 and 123-Q with 123 (LRD).

(2) Ditch 123-A. See subsequent report for this system.

(3) Ditch 123-B. This ditch is tidal for its entire length and no improvement is thought necessary.

(4) Ditch 123-C. This ditch is tidal for its entire length and no improvement is thought necessary.

(5) Ditch 123-D. Install 1/2 round invert tile from junction with 123-D-1 to end of system. Fill swampy area on both sides of ditch for section near junction with 123-D-6 to drain to ditch 123-D. Repair sanitary sewer which is clogged and overflowing through a manhole located on north bank of ditch 123-D near junction with 123-D-4-A. All of above (IN).

(6) Ditch 123-D-3. Install 1/2 round invert tile (LRD).

(7) Ditch 123-D-4. Install 1/2 round invert tile from junction with 123-D to junction with 123-D-4-B (IN). Raise grade from this point to end of system by filling old ditch channel and install 1/2 round invert tile to maintain local drainage (IN).

(8) Ditch 123-D-4-A. Install 1/2 round invert tile (IN).



(9) Ditch 123-D-4-B. Install 1/2 round invert tile, filling swampy area and both sides of ditch to drain to it (IN).

(10) Ditches 123-D-5, 123-D-5-A and 123-D-5-B. Install 1/2 round invert tile (IN).

(11) Ditch 123-D-6. Install 1/2 round invert tile from junction with 123-D to junction with 123-D-6-A. Fill swampy area on both sides of ditch to drain to it (IN).

(12) Ditch 123-F. Install 1/2 round invert tile from junction with 123-F-1 to end of system (IN).

(13) Ditches 123-F-2, 123-F-2-A and 123-F-3. Install 1/2 round invert tile (IN).

(14) Ditch 123-G. This ditch is tidal for its entire length and no improvement is thought necessary.

(15) Ditch 123-H. Pave invert of section located above elevation 0.50 feet (LRD).

(16) Ditch 123-J and tributaries.

(a) Ditch 123-J. Pave invert from junction with 123 to junction with 123-J-9 (LRD). See subsequent report for system upstream from junction with 123-J-9.

(b) Ditch 123-J-1. Pave invert of section located above elevation 0.50 feet (LRD). See subsequent report for system above junction with 123-J-1-A.

(c) Ditch 123-J-2. Pave invert of section located above elevation 0.50 feet (LRD). See subsequent report for system above junction with 123-J-2-A.

(d) Ditches 123-J-3, 123-J-4, 123-J-5, 123-J-6, 123-J-7, 123-J-7-A and 123-J-8. Pave inverts of sections of these ditches located above elevation 0.50 feet (LRD).

(17) Ditch 123-K. Install 1/2 round invert tile from junction with 123 to junction with 123-K-1 (LRD).

(18) Ditch 123-L. Install 1/2 round invert tile (LRD).

(19) Ditch 123-M. Pave invert and side slopes (LRD).

(20) Ditch 123-N. Install 1/2 round invert tile from junction with 123 to a point 200 feet upstream from junction with 123-N-1 (LRD)

(21) Ditch 123-N-1. Install 1/2 round invert tile (LRD).



(22) Ditches 123-P, 123-P-1 and 123-P-3.  
Install 1/2 round invert tile (IN).

(23) Ditch 123-Q. Pave invert and side slopes from junction with 123 to junction with 123-Q-8 (IN). Install 1/2 round invert tile from this latter point to 24" culvert under runway (IN).

(24) Ditch 123-Q-1. Install 1/2 round invert tile including the indicated tributaries (IN).

(25) Ditches 123-Q-2 and 123-Q-4. Install 1/2 round invert tile (IN).

(26) Ditch 123-Q-3. Install 1/2 round invert tile from junction with 123-Q to end of system (IN).

(27) Ditch 123-Q-3-A. Install 1/2 round invert tile from junction with 123-Q-3 to junction with 123-Q-3-A-2 (LRD).

(28) Regrade area located about 200 feet south-east of junction of ditches 123-Q-3-A and 123-Q-3-A-2 (IN).

(29) Ditches 123-Q-3-A-1 and 123-Q-3-B. Install 1/2 round invert tile (LRD).

(30) Ditch 123-Q-5. Install 1/2 round invert tile (NFD).

(31) Ditch 123-Q-6. Install 1/2 round invert tile from junction with 123-Q to junction with 123-Q-6-B. Pave inlet of 24" culvert at this latter junction. (IN)

(32) Ditch 123-Q-7. Install 1/2 round invert tile including the indicated tributary (IN).

(33) Ditches 123-Q-8, 123-Q-6-A and 123-Q-9.  
Install 1/2 round invert tile.(IN).

(34) Ditch 123-Q-10. Install 1/2 round invert tile (LRD).

(35) Regrade area located about 150 feet southwest of ditch 123-Q-10 (IN).

(36) Ditch 123-R. Fill this ditch which is an abandoned major channel and install 1/2 round invert tile to provide for local drainage (LRD).

(37) Ditch 123-S. Pave invert from junction with 123 to within 400 feet of end of system (LRD).

(38) Ditch 123-T. Install 1/2 round invert tile including the indicated tributary (LRD).

(39) Straighten and install 1/2 round invert tile (LRD).

(40) Ditch 123-V. Straighten and pave invert and side slopes from junction with 123 to outlet of storm sewer located about 200 feet upstream from junction with 123-V-4. Fill inverts of inlet boxes in sewered section with concrete to eliminate standing water. (LRD).

(41) Ditches 123-V-2, 123-V-2-A, 123-V-2-A-1, 123-V-3 and 123-V-3-A. Install 1/2 round invert tile (LRD).

(42) Ditches 123-V-1 and 123-V-4. Fill and abandon (LRD).

(43) Ditch 123-W. Pave invert. Fill sections of old ditch channel located along south bank of this ditch. (LRD).

(44) Ditch 123-X. Install 1/2 round invert tile from junction with 123 to a point 200 feet upstream from junction with 123-X-1 (LRD).

(45) Ditch 123-X-1. Install 1/2 round invert tile from junction with 123-X to a point 300 feet upstream from this junction (LRD).

(46) Ditch 123-Y. Pave invert from junction with 123 to the 24" culvert under the Trans-Isthmian Highway (LRD).

(47) Ditch 123-Y-1. Install 1/2 round invert tile (LRD).

(48) Ditch 123-Y-2. Install 1/2 round invert tile from junction with 123-Y to junction with 123-Y-2-A (LRD).

(49) Ditches 123-Z and 123-A-A. Install 1/2 round invert tile (LRD)

(50) Ditch 123-S-1. Install 1/2 round invert tile (LRD).

d. Drainage System No. 124.

(1) Ditch 124. Regrade and install 1/2 round invert tile (LRD).

e. Drainage System No. 125.

(1) Ditch 125. Install 1/2 round invert tile from junction with the Coco Solo River to the point where existing paved section begins (U.S. Navy LRD).

(2) Ditch 125-A. Install 1/2 round invert tile ( U.S. Navy property LRD).

f. Drainage System No. 127.

(1) Ditch 127. Pave invert and side slopes from junction with the Coco Solo River to the 36" culvert under runway (IN).

(2) Ditch 127-A. Fill ditch which is an abandoned major channel and install 1/2 round invert tile to provide local drainage (IN).

(3) Ditch 127-B. Pave invert and side slopes from junction with 127 to the 60" culvert under runway (IN). Install 1/2 round invert tile from inlet of culvert under runway to end of system (LRD).

(4) Ditch 127-B-1. Install 1/2 round invert tile from junction with 127-B to junction with 127-B-1-A (IN). Install 1/2 round invert tile for remainder of system (LRD).

(5) Ditch 127-B-2. Reshape inverts of inlet boxes in this system to prevent retention of water (IN).

(6) Ditch 127-B-3. Install 1/2 round invert tile with a culvert under the road to the control tower (IN).

(7) Ditch 127-C. Pave invert and side slopes from junction with 127 to junction with 127-C-1 (IN). Install 1/2 round invert tile from this latter point to the 2 - 18" culverts under roadway (IN).

(8) Ditch 127-C-1. Install 1/2 round invert tile from junction with area of impounded water (IN).

(9) Ditches 127-D and 127-E. Install 1/2 round invert tile (IN).

g. Drainage System No. 128.

(1) Ditch 128. Pave invert and side slopes from junction with Coco Solo River to the culvert immediately upstream from junction with 128-J (LRD).

(2) Ditches 128-A, 128-B and 128-C. Install 1/2 round invert tile (LRD).

(3) Ditch 128-D. Install 1/2 round invert tile (Part U.S. Navy property. LRD).

(4) Ditch 128-E. Pave invert and side slopes from junction with 128 to junction with 128-E-4 (LRD). See subsequent report for system above this junction.

(5) Ditches 128-E-1 and 128-E-2. Install 1/2 round invert tile (LRD).



(6) Ditch 128-E-3. See subsequent report for this system.

(7) Ditch 128-E-4. Pave invert and side slopes from junction with 128-E to junction with 128-E-4-B (LRD). See subsequent report for system above this point.

(8) Ditches 128-E-4-A and 128-E-4-B. Install 1/2 round invert tile including the indicated tributaries (LRD).

(9) Ditch 128-F. Install 1/2 round invert tile (LRD).

(10) Ditch 126-F-1. Install 1/2 round invert tile from junction with 128-F to junction with 128-F-1-D (LRD).

(11) Ditch 128-G. Install 1/2 round invert tile (LRD)

(12) Ditch 128-H. Install 1/2 round invert tile from junction with 128 to junction with 128-H-1 (LRD). See subsequent report for system above this junction.

h. Drainage System No. 129.

(1) Ditches 129 and 129-A. Fill ditches which are abandoned major drainage channels and install 1/2 round invert tile to provide local drainage (IN).

k. Drainage System No. 130.

(1) Ditch 130. Fill ditch which is an abandoned major drainage channel and install 1/2 round invert tile to provide local drainage (IN).

(2) Ditch 130-A. Install 1/2 round invert tile (IN).

m. Drainage System No. 131.

Ditch 131. Pave outlet of 24" culvert located about 100 feet upstream from junction with 131-A (IN)

n. Drainage System No. 132.

(1) Ditch 132. Pave invert and side slopes from junction with Coco Solo River to junction with 132-E (LRD). See subsequent report for system above this junction.

(2) Ditch 132-A. Install 1/2 round invert tile from junction with 132 to junction with 132-A-1 (LRD).

(3) Ditch 132-B. Install 1/2 round invert tile from junction with 132 to junction with 132-B-1 (LRD).

(4) Ditch 132-C. Install 1/2 round invert tile (LRD).

(5) Ditch 132-D. See subsequent report for this system.

p. Drainage System No. 133.

Ditch 133. Pave invert and side slopes from west fence around fuel storage area to end of system (IN).

q. Drainage System No. 134.

(1) Ditch 134. Straighten and pave invert and side slopes from France Field By-Pass Road or Naval Reservation fence line to the 24" culvert located about 400 feet upstream from junction with 134-J. (IN).

(2) Ditch 134-A. Straighten regrade and install 1/2 round invert tile from junction with 134 to the 24" culvert under taxiway (IN).

(3) Ditches 134-B. and 134-C. Install 1/2 round invert tile (LRD).

(4) Ditch 134-E. Pave invert from junction with 134 to the 24" culvert under France Field By-Pass Road (LRD).

(5) Ditch 134-F. Install 1/2 round invert tile from relocated section of 134 to junction with 134-F-1 (IN).

(6) Ditch 134-G. Install 1/2 round invert tile from relocated section of 134 to end of system (IN).

(7) Ditch 134-H. Install 1/2 round invert tile (IN).

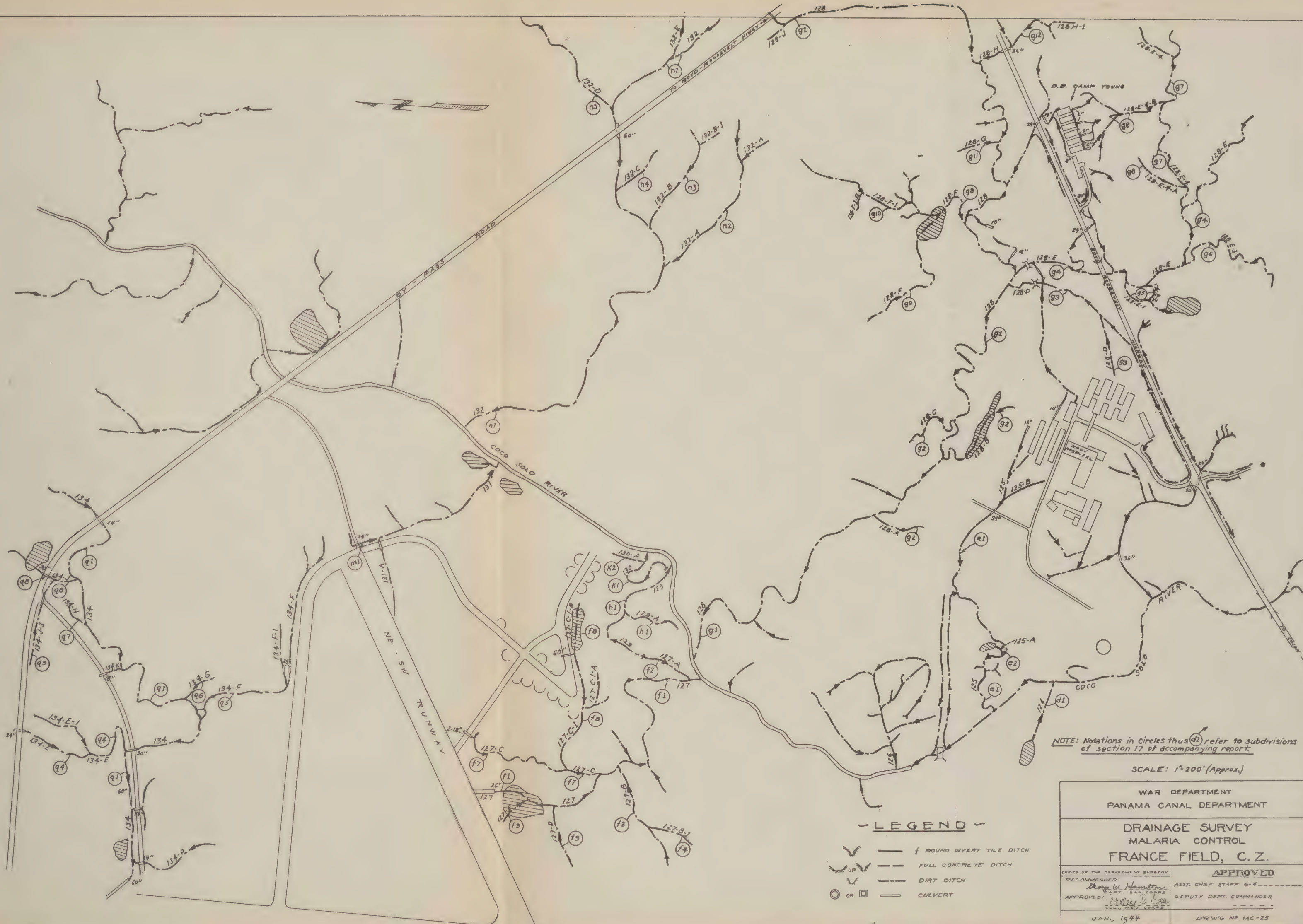
(8) Ditch 134-J. Lower culvert under France Field By-Pass Road or fill area and raise ditch grade upstream from this culvert to eliminate extensive area of impounded water. Install 1/2 round invert tile from junction with 134 to this culvert (IN).

(9) Ditch 134-J-1. Regrade (IN).

r. Drainage Systems Nos. 136, 137, 138, 139, 140, 141, 142, 143, 144 and 145.

(1) The above ditches, including the indicated tributaries, are tidal, and no improvement is considered necessary. Periodic maintenance of these ditches will be required.





NOTE: Notations in Circles thus  $\textcircled{d2}$  refer to subdivisions of section 17 of accompanying report.

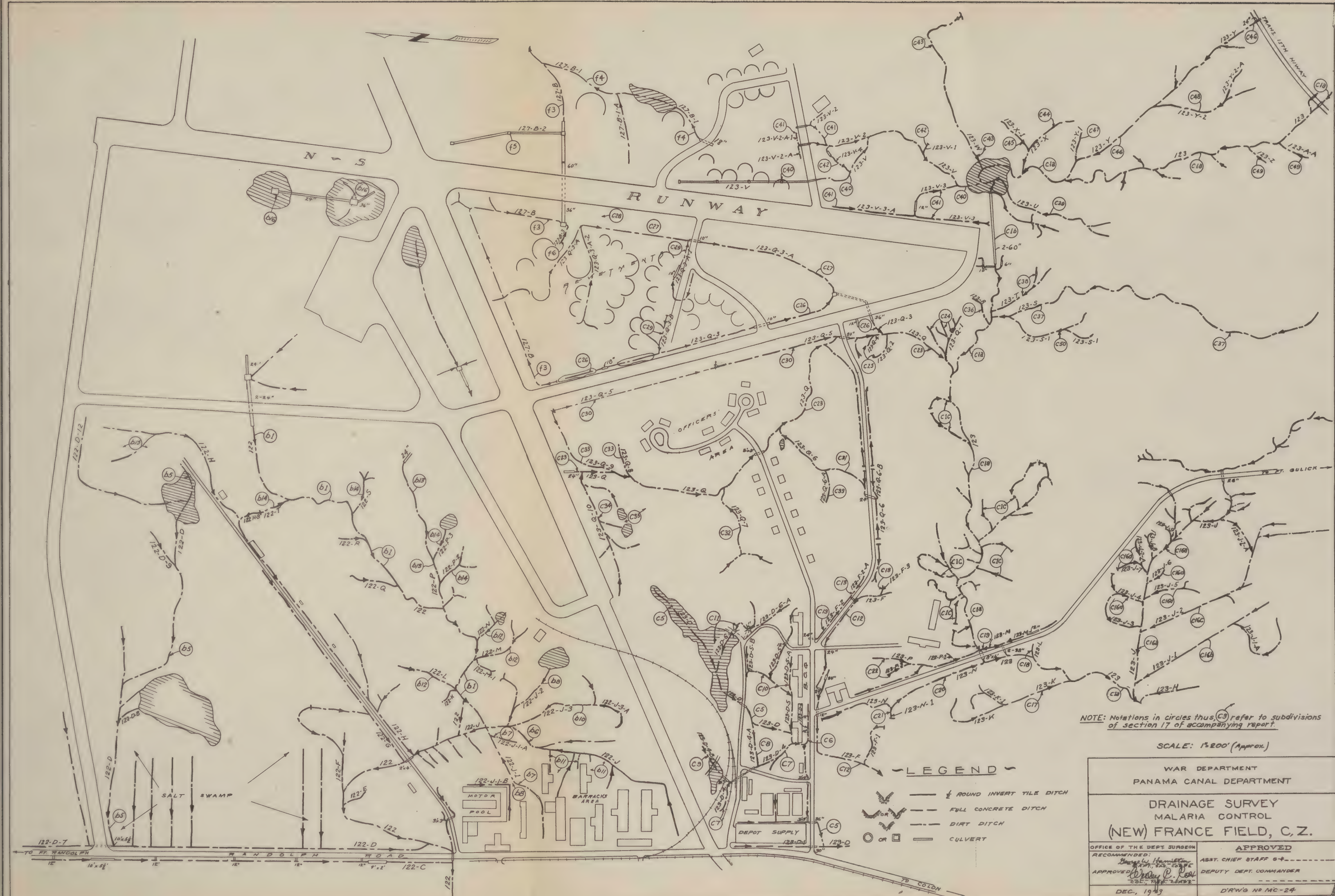
SCALE: 1" = 200' (Approx.)

- LEGEND**
- ROUND INVERT TILE DITCH
  - FULL CONCRETE DITCH
  - DIRT DITCH
  - OR CULVERT

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL FRANCE FIELD, C. Z.	
OFFICE OF THE DEPARTMENT SURGEON RECOMMENDED: <i>George W. Hamilton</i> CAPT. SAN. CORPS	APPROVED ASST. CHIEF STAFF G-4
APPROVED: <i>W. H. D. [Signature]</i> COL. MED. CORPS	DEPUTY DEPT. COMMANDER
JAN., 1944	D/R/W/G NS MC-25







NOTE: Notations in circles thus (C3) refer to subdivisions of section 17 of accompanying report.

SCALE: 1"=200' (Approx.)

LEGEND

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
(NEW) FRANCE FIELD, C.Z.

OFFICE OF THE DEPT. SURGEON RECOMMENDED: <i>Sherrill Hamilton</i> APPROVED: <i>W. C. P. [Signature]</i> DEC. 1947	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER D'RWD NO MC-24 MRAT
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MALARIA CONTROL - DRAINAGE SURVEY

PANAMA CANAL DEPARTMENT

APRIL 1944



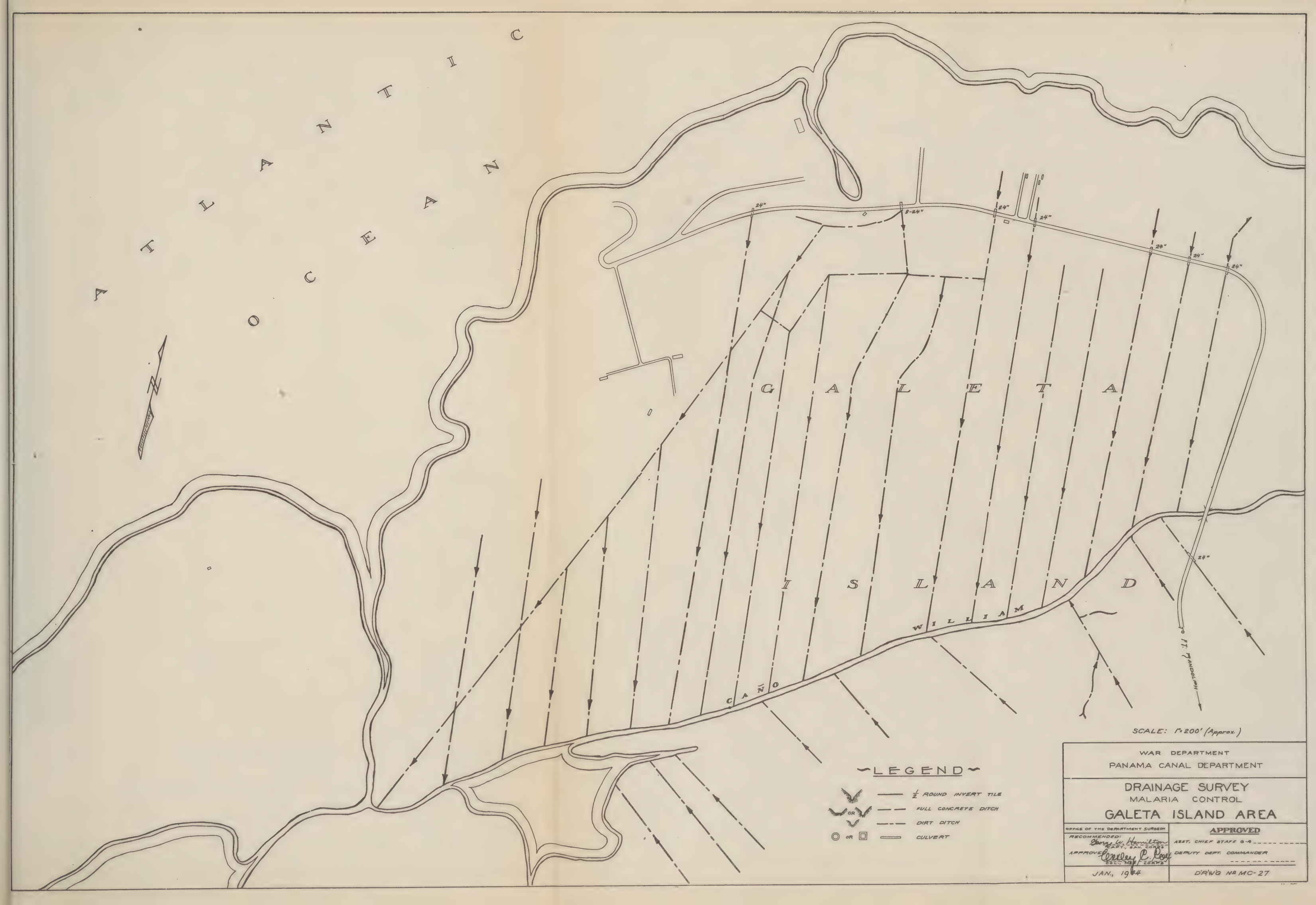
18. SPECIFIC REPORT ON GALETA ISLAND AREA ( AREA NO. 15)

a. Area included. - Ft. Randolph Military Reservation North and West of Road to Galeta Point, including Palma Media Island, Galeta Island and adjacent area, as indicated on accompanying Maps M.C. 27 and M.C. 28.

b. This area for the greater part is a tidal swap through which ditches have been cut at frequent and regular intervals. These ditches are in excellent condition and permit positive salt water flushing of the swampy areas. The areas above the swamp are drained by natural and improved drainage courses generally having steep slopes and conveying surface run-off only with no continuous feeding by ground water. At the time the survey was made (March 1944) no water was found in any of these ditches. Accordingly, no work is thought necessary in this area.







GALETA ISLAND

GALETA ISLAND

WILLIAM D

CANAL

SCALE: 1"=200' (Approx.)

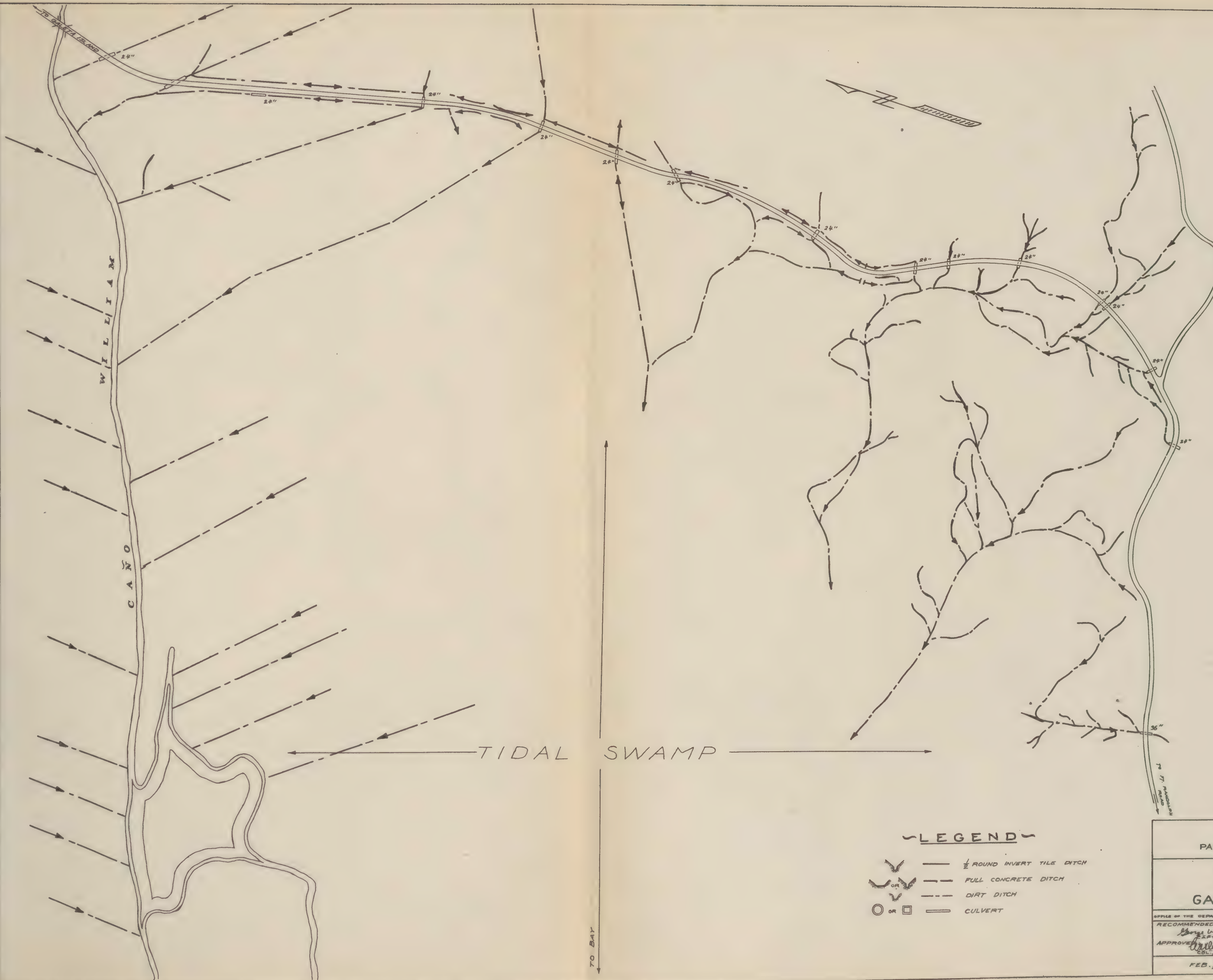
~LEGEND~

- 1/2 ROUND INVERT TILE
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL GALETA ISLAND AREA	
OFFICE OF THE DEPARTMENT SURGEON RECOMMENDED: <i>[Signature]</i> CAPT. SAN CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
JAN. 1944	DRAWG NO MC-27







SCALE: 1"=200' (Approx.)

**~LEGEND~**

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
<b>DRAINAGE SURVEY MALARIA CONTROL GALETA ISLAND AREA</b>	
<small>OFFICE OF THE DEPARTMENT SURGEON</small> RECOMMENDED: <i>Wm. Hamilton</i> <small>1ST LT. EAST. CORPS</small> APPROVED: <i>Wm. P. Cox</i> <small>COL. MED. CORPS</small>	<b>APPROVED</b> <small>ASST. CHIEF STAFF G-4</small> DEPUTY DEPT. COMMANDER FEB., 1944 D'RWG NR MC-28

TO BAY



Recommended George W. Hamilton  
Captain, Sanitary Corps.

Approved Wesley C. Cox  
Colonel, Medical Corps.

APPROVED:

Assistant Chief of Staff, G-4 \_\_\_\_\_

Deputy Department Commander \_\_\_\_\_





EXHIBIT B



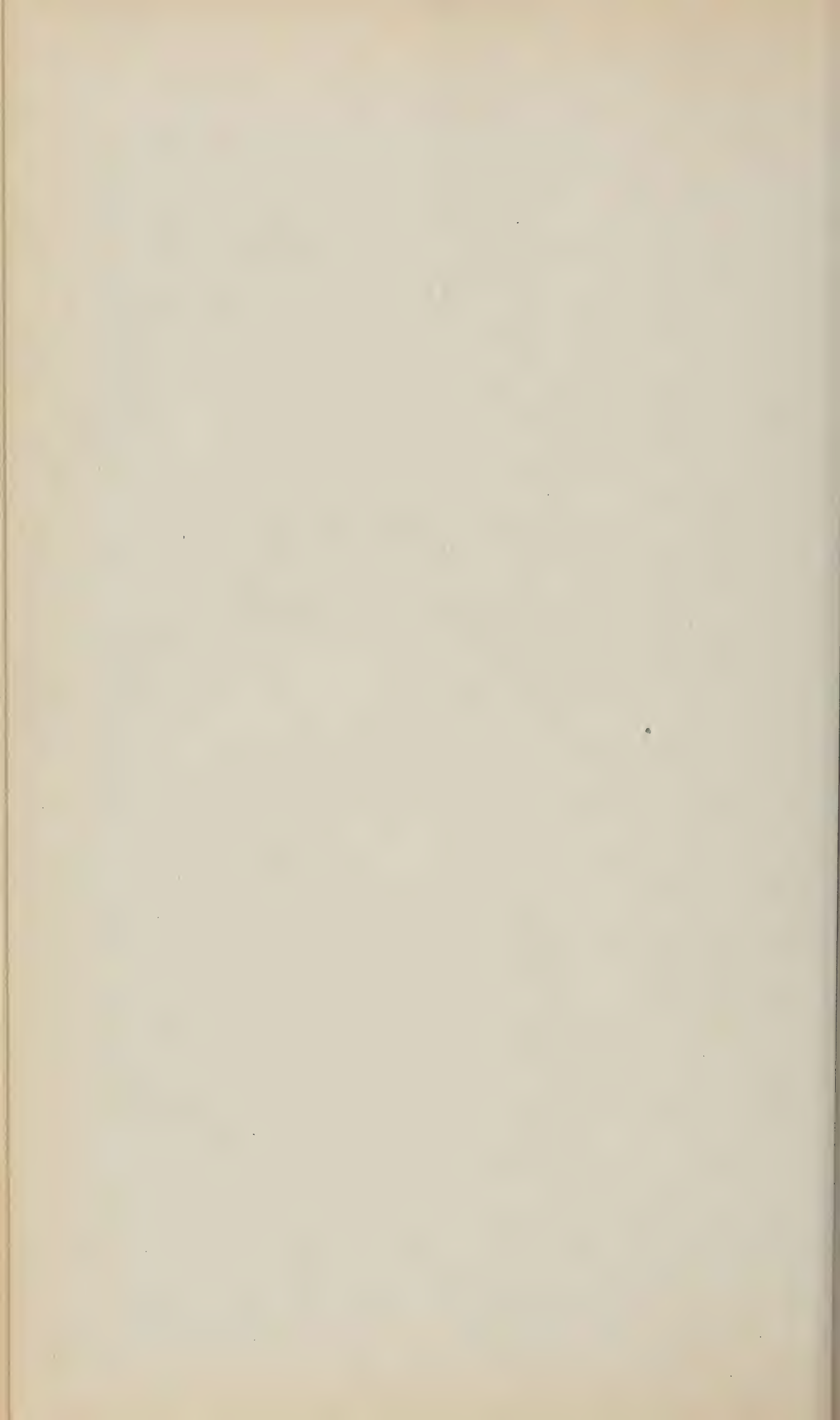


MALARIA CONTROL - DRAINAGE SURVEYS

Supplementary Report Listing Projects  
Proposed for Construction During Fiscal  
Year 1946

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December 1944



MALARIA CONTROL - DRAINAGE SURVEYS

COROZAL - AREA No. 1

Supplementary Report Listing Projects  
Proposed For Construction During  
Fiscal Year 1946

---

December 1944





MALARIA CONTROL

DRAINAGE SURVEYS

DECEMBER 1944

Supplementary report on Corozal (Area No. 1 ) listing work proposed for construction during the Fiscal Year 1946. Reference Maps M.C. 1 and M.C. 2. Preliminary estimated cost: Army Property \$8600; Panama Canal Property \$6800; Total Cost \$15,400.

1. Pave invert and side slopes of Ditch 3 from Canal to junction with Ditch 3-A. Install 36" culvert under railroad spur near Canal bank (Part Panama Canal Property).

2. Pave invert and side slopes of Ditch 10 from 4.2' x 5' culvert under railroad spur to 4.2' x 4' culvert under main P.R. culvert at junction with Ditch 10-C (Panama Canal Property).

3. Pave side slopes of Ditch 10 from junction with Ditch 10-C to 4.5' x 4' culvert under Gaillard Highway. (Panama Canal Property).

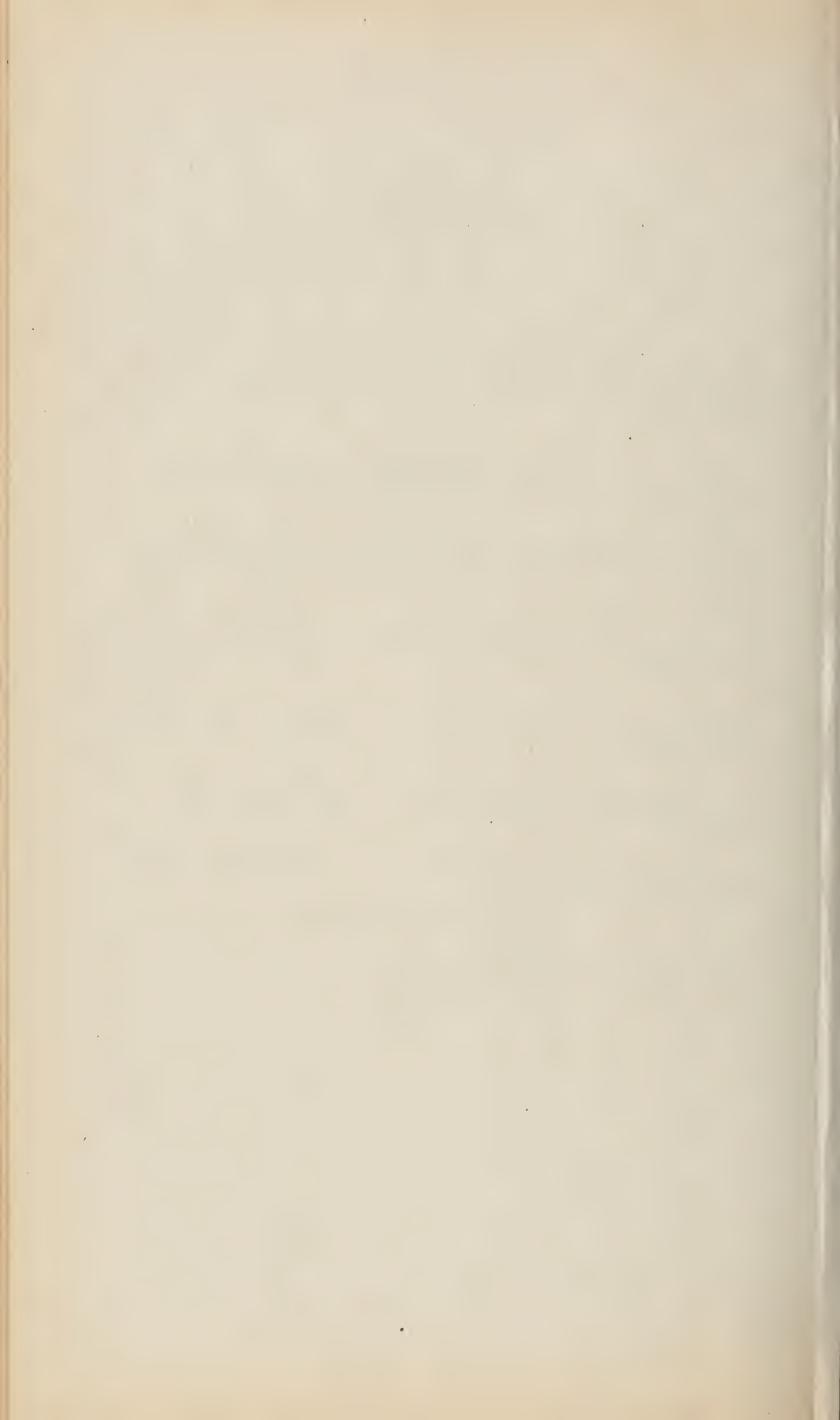
4. Pave side slopes of Ditch 10-D from junction with Ditch 10 to 6' x 6' culvert under Gaillard Highway. (Panama Canal Property).

5. Install 14" one-half round invert tile laid to maximum practicable grade in following Ditches (Panama Canal Property):

a. Ditch 10-C from junction with Ditch 10 to 21" culvert at Gaillard Highway.

b. Ditches 10-D-1 and 10-D-2.

c. Ditch 10-D-3 from junction with Ditch 10-D to 24" culvert at Gaillard Highway.







ENLARGED SECTION "A"  
N.R. 5

~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- 15" CULVERT

NOTE: Notations in circles thus (62) refer to subdivisions of section 4 of accompanying report

SCALE: Approx. 1:2400

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL COROZAL, C.Z.	
OFFICE OF THE DEPT. SURGEON RECOMMENDED <i>Wm. W. Hamilton</i> CAPT., SAN. CORPS	APPROVED ASST. CHIEF STAFF G-4
APPROVED <i>Wm. W. Hamilton</i> COL., INF. CORPS	DEPUTY DEPT. COMMANDER
JUNE 1943	DRW'G NO MC-1







~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- 18" CULVERT
- TILE DITCH

NOTE: Notations in circles thus (e2) refer to subdivisions of Section 4 of accompanying report

SCALE: Approx. 1:2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
COROZAL C.Z.

OFFICE OF THE DEPT. SURGEON	APPROVED
RECOMMENDED [Signature]	ASST. CHIEF STAFF G-4
APPROVED [Signature]	DEPUTY DEPT. COMMANDER
JUNE 1943	DRWG NO. 14C-2





Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps





MALARIA CONTROL - DRAINAGE SURVEYS

COROZAL CEMETERY - AREA NO. 2

Supplementary Report Listing Projects  
Proposed For Construction During  
Fiscal Year 1946

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December 1944



MALARIA CONTROL

DRAINAGE SURVEYS

December 1944

Supplementary report on Corozal Cemetery (Area No. 2 ), listing work proposed for construction during the Fiscal Year 1946. Reference Map M.C. 3. Preliminary Estimated Cost \$10,800. All work on Panama Canal Property.

1. Pave side slopes of Ditch 10 from Gaillard Highway to junction with Ditch 10-G (Panama Canal Property).

2. Install 14" one-half round invert tile laid to maximum practicable grade in following ditches (Panama Canal Property):

a. Ditches 10-D and 10-D-3 from Gaillard Highway to a point 50 feet upstream from culvert under Gaillard Highway.

b. Ditch 10 from a point about 600 feet upstream from junction with Ditch 10-J to a point 50 feet upstream from the 36" culvert under Corozal Clayton Road.

c. Ditch 10-J from junction with Ditch 10-J-4 to a point 1500 feet upstream from this junction.

d. Ditch 10-J-4 from junction with Ditch 10-J to 18" culvert under Old Empire Road.

e. Ditch 10-L from 24" culvert under Corozal-Clayton Road to a point 600 ft. upstream from this culvert.

f. Ditch 10-C-1 from 21" culvert under Gaillard Highway to a point 200 ft. upstream from this culvert.

g. Ditch 5-R-1-B from 20" culvert under Corozal-Clayton Road to a point 700 ft. upstream from this culvert.







# LEGEND

- $\frac{1}{2}$  ROUND INVERT TILE
- FULL CONC.
- DIRT
- CULVERT

RECOMMENDED  
CAPT. CORPS OF ENGINEERS

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

## DRAINAGE SURVEY MALARIA CONTROL COROZAL CEMETERY & VICINITY

OFFICE OF THE DEPT. SURGEON  
RECOMMENDED *Thos. D. Hamilton*  
CAPT. SAN. CORPS  
APPROVED *COL. MED. CORPS*

APPROVED  
ASST. CHIEF STAFF G-4  
DEPUTY DEPT. COMMANDER

JULY 1943  
DRWG NO. M.C. 3

Scale: 1"=200'





Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps



MALARIA CONTROL - DRAINAGE SURVEYS

ALBROOK FIELD - AREA No. 3

Supplementary Report Listing Projects  
Proposed For Construction During  
Fiscal Year 1946

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December 1944





MALARIA CONTROL

DRAINAGE SURVEYS

DECEMBER 1944

Supplementary report on Albrook Field (Area No. 3) listing work proposed for construction during the Fiscal Year 1946. Reference Maps M.C. 4, M.C. 5, and M.C. 6. Preliminary Estimated Cost \$10,500. All work on Army Property.

1. Pave invert and side slopes of Ditch 11-L from junction with Ditch 11-L-11 to a point 1000 ft. upstream from this junction.

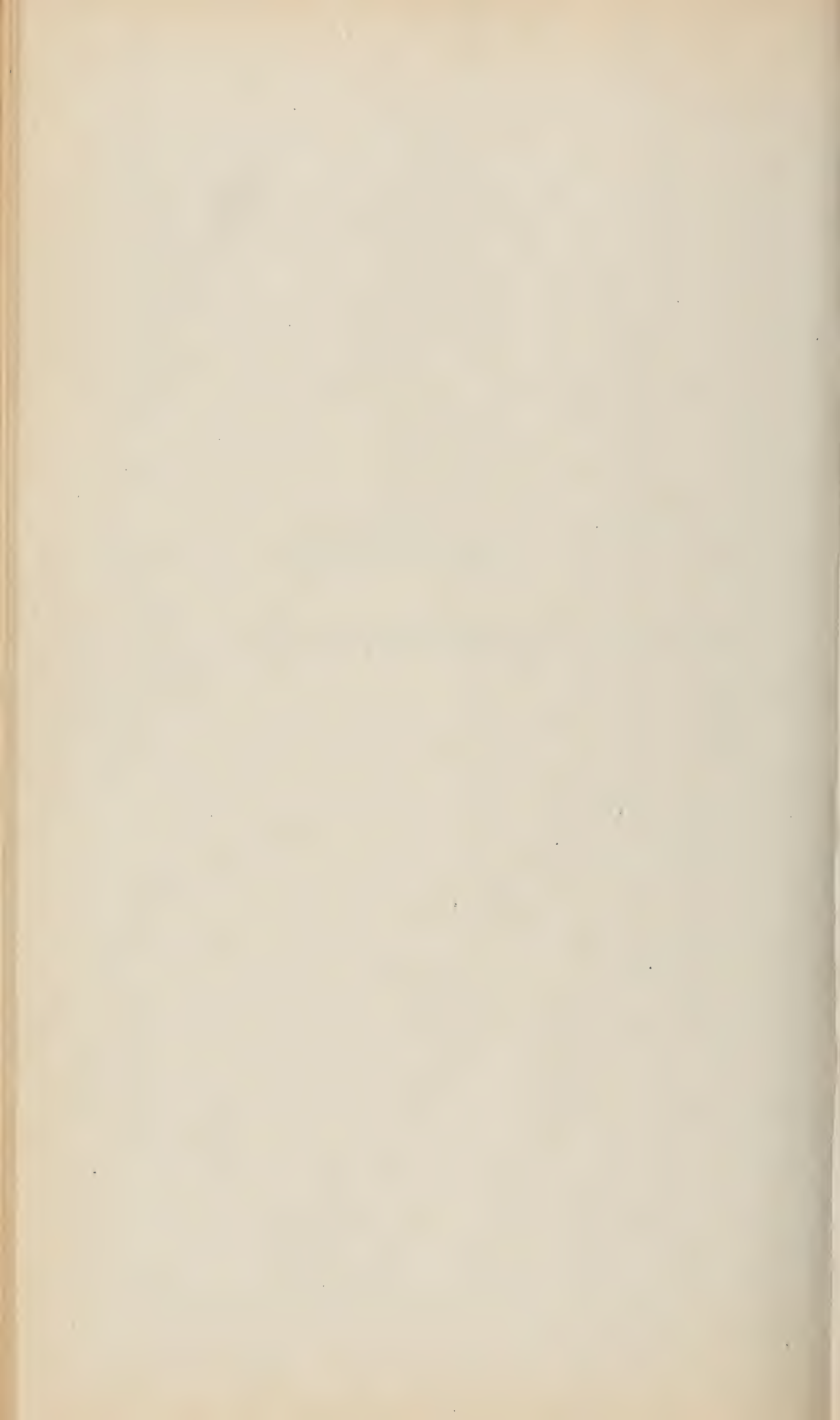
2. Complete filling, regrading and draining areas in former revetment areas and other areas adjacent to runways and taxi strips.





Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps





NOTE: Notations in circles thus (b8) refer to subdivisions of section 6 of accompanying report.

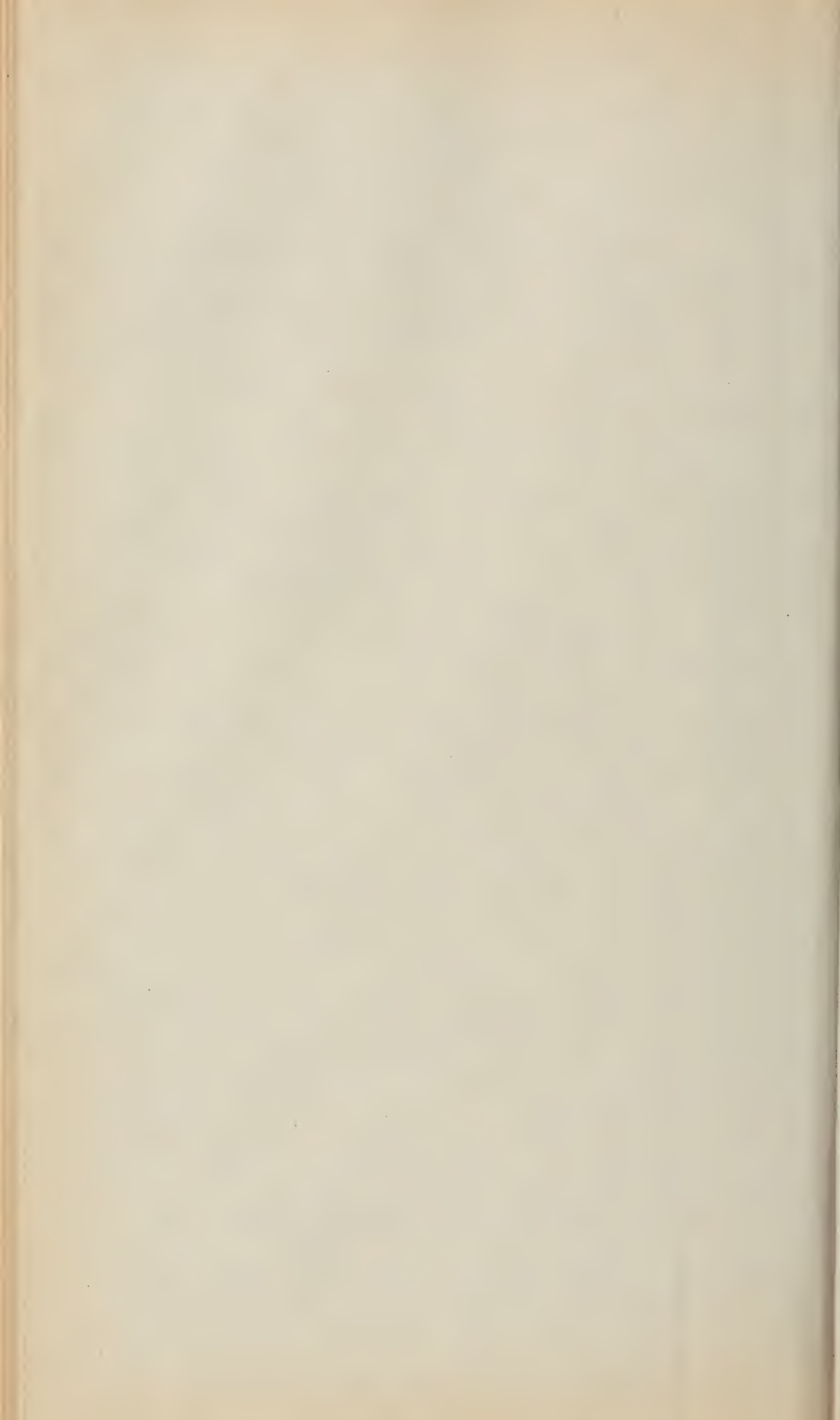
SCALE: Approx V: 1400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
ALBROOK, C. Z.

OFFICE OF THE DEPT. SURGEON RECOMMENDED Surge W. Hamilton CAPT. SAN. CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
APPROVED COL. MED. CORPS	
AUGUST 1943	DRWG NO M-C-4





NOTE: Notations in circles thus, (C) refer to subdivisions of section 6 of accompanying report.



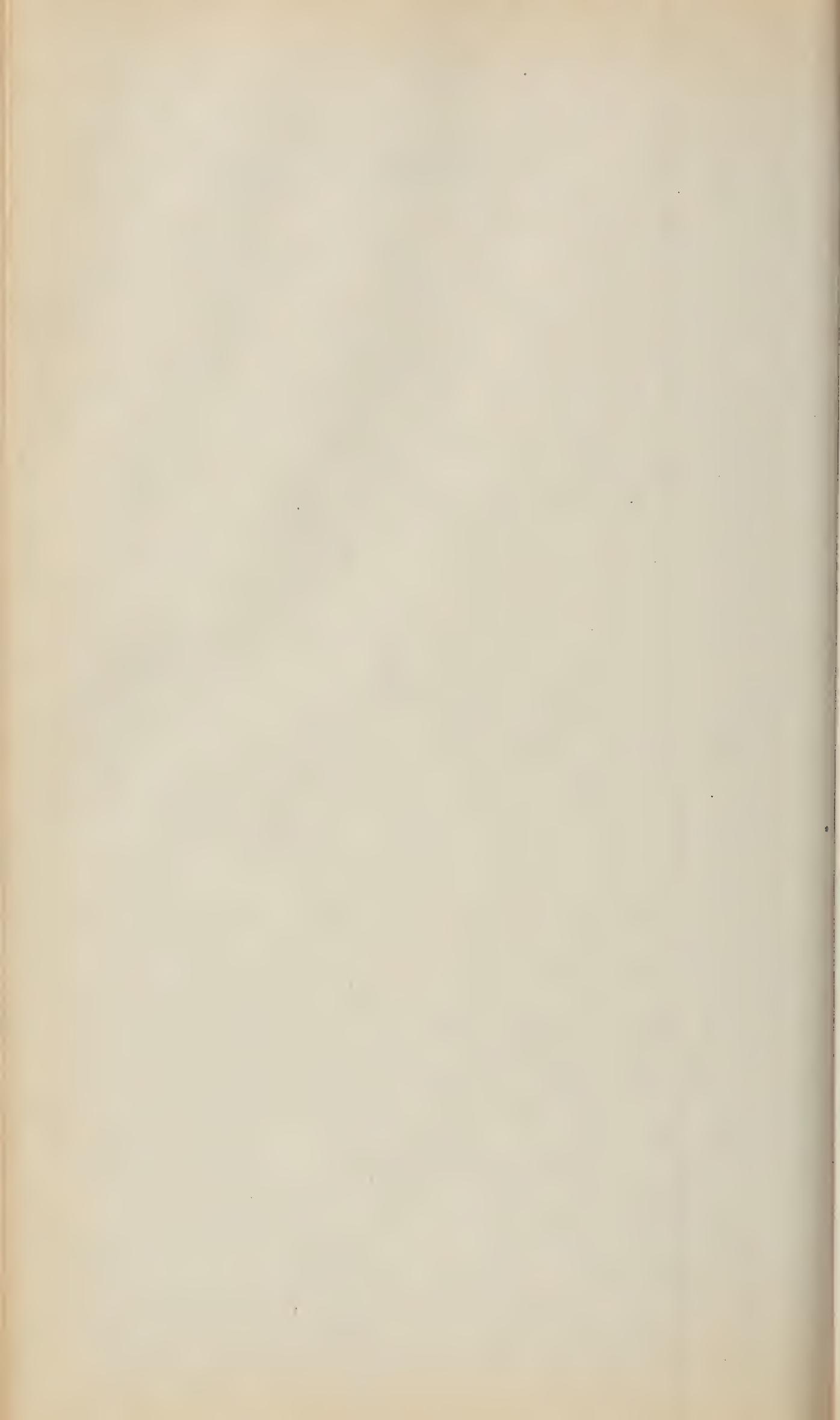
SCALE - Approx. 1:2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
ALBROOK, C. Z.

OFFICE OF THE DEPT. SURGEON RECOMMENDED <i>George W. Hamilton</i> CAPT. SAN. CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
APPROVED COL. MEB. CORPS	
AUGUST 1943	DRWG NO. MC-5











MALARIA CONTROL - DRAINAGE SURVEYS

Outlying Area Along Albrook-Clayton  
Highway - Area No. 5

Supplementary Report Listing Projects  
Proposed For Construction During Fiscal  
Year 1946

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December 1944





## MALARIA CONTROL

### DRAINAGE SURVEYS

DECEMBER 1944

Supplementary report on Outlying Area along Albrook-Clayton Highway (Area No. 5 ) listing work proposed for construction during the Fiscal Year 1946. Reference Map M.C. 9. Preliminary Estimated Cost \$80,700. All work on Army Property.

1. Pave invert and side slopes of following ditches:

a. Ditch 11-G from junction with Ditch 11-G-12 to a point 500 ft. upstream from junction with 11-G-16.

b. Ditch 11-G from a point 100 ft. downstream from 6' x 6' culvert under Albrook Magazine road to a point 900 ft. upstream from this culvert.

c. Ditch 11-L from junction with Ditch 11-L-12 to a point 800 ft. upstream from junction with Ditch 11-L-14.

d. Ditch 45-F from junction with Ditch 45 to junction with Ditch 45-F-10.

e. Ditch 45-F-1 from junction with Ditch 45-F to 24" culvert under Albrook- Clayton Road.

f. Ditch 45-K from fence around gasoline storage area to a point 1000 ft. upstream from this fence.

g. Ditch 47 from Cardenas River to junction with Ditch 47-D.

h. Ditch 47-A from junction with Ditch 47 to pipe line crossing.

i. Ditch 47-D from junction with Ditch 47 to 33" culvert under Albrook-Clayton Road.

Above ditches to be straightened where required to remove abrupt changes in direction and abandoned sections of channels to be backfilled to insure complete drainage. Adjacent banks to be regraded where required to drain to paved ditches. Inverts of ditches may be 14" or larger precast concrete tile or may be monolithic concrete slightly pitched to center. Side slopes may be precast or monolithic concrete provided with frequent weep holes where required.





2. Install 14" one-half round invert tile laid to maximum practicable grades in the following ditches:

- a. Ditches 11-L-12 and 11-L-12-A.
- b. Ditches 45-P, 45-Q, 45-T and 45-T-1.
- c. Ditches tributary to Ditch 45-F-1 for section between junction of Ditch 45-F-1 with Ditch 45-F and 24" culvert under Clayton-Albrook Road.
- d. Ditches 45-F-2, 45-F-3. 45-F-4, 45-F-5, 45-F-6, 45-F-7, 45-F-8 and 45-F-7-A.
- e. Ditch 47 from junction with Ditch 47-D to 24" culvert under Clayton-Albrook Road.
- f. Ditches 47-B and 47-C.
- g. Ditch 47-A-1.
- h. Ditch 47-A upstream from pipe line crossing.
- i. Ditch 45-A from junction with Ditch 45 to junction with Ditch 45-A-2.
- j. Ditch 45-A-1.



NOTE: Notations in circles thus (C4) refer to subdivisions of section 8 of accompanying report.

# ~ LEGEND ~

-  1/2 ROUND INVERT TILE DITCH
  -  FULL CONCRETE DITCH
  -  DIRT DITCH
  -  CULVERT
- SCALE: Approx 1:5000

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
OUTLYING AREA ALONG  
ALBROOK-CLAYTON HIWAY

OFFICE OF THE DEPT. SURGEON

RECOMMENDED:

APPROVED:

COL. FRED. COOPER

APPROVED

ASST. CHIEF STAFF G-4

DEPUTY DEPT. COMMANDER

DRAWINGS BY

ENGINEERING SECTION, R.E.D.

DRAWN BY: HEDYKE

SUBMITTED BY: CAPT. C.E.

AUGUST 1943

DRWG NO MC-9





Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps





MALARIA CONTROL - DRAINAGE SURVEYS

FT. KOBBER - AREA NO. 6.

Supplementary Report Listing Projects  
Proposed For Construction\* During  
Fiscal Year 1946

---

December 1944





MALARIA CONTROL

DRAINAGE SURVEYS

DECEMBER 1944

Supplementary report on Ft. Kobbe-Howard Field (Area No. 6 ) listing work proposed for construction during the Fiscal Year 1946. Reference Maps M.C. 10, M.C. 11, M.C. 12 and M.C. 13. Preliminary Estimated Cost \$101,500. All work on Army Property.

1. Pave invert and side slopes of following Ditches:

a. Ditch 50-B from a point 400 ft. upstream from junction with Ditch 50 to a point 200 ft. downstream from 2- 36" culverts under taxiway.

b. Ditch 50-C from junction with Ditch 50-C-2 to point of existing paved section 100 ft. downstream from Howard Ave.

c. Ditch 50-B from junction with Ditch 50-B-11 to end of ditch near runway cross-over.

d. Ditch 51 from junction with Ditch 51-F to junction with Ditch 51-R.

e. Ditch 51-F from junction with Ditch 51 to a point 600 ft. upstream from junction with Ditch 51-F-8.

f. Ditch 50-B-11 from junction with Ditch 50-B to end of ditch.

g. Ditch 51-F-4-D from 30" culvert at junction with Ditch 51-F-4 to end. Include new 24" culvert under taxiway between East and West strips of runway.

h. Ditch 51-A from 36" culvert under runway to end of ditch.

i. Ditch 51-C-2-B from 36" culvert under runway to end of ditch.

j. Ditch 200 from a point 100 ft. downstream from culvert under taxiway to end of ditch.

k. Ditch 51-X from junction with Ditch 51 to end of Ditch.

2. Install 14" one-half round invert tile laid to maximum practicable grade in following Ditches:

a. Ditch 51-H from junction with Ditch 51 to junction with Ditch 51-H-1.

b. Ditch 51-H-1 from junction with Ditch 51-H to a point 200 ft. upstream from this junction.

c. Ditches 51-N, 51-P and 51-Q.

d. Ditch 51-F-4 from junction with 51-F-4-D to end.

e. Ditch 51-F-5 from 18" culvert at junction with Ditch 51-F-5-E to end.

f. Ditch 51-F-5-A from 15" culvert at junction with Ditch 51-F-5-A-1 to next 12" culvert.

g. Ditch 51-F-7 from 24" culvert at junction with Ditch 51-F-7-D to a point 500 ft. upstream from this junction.

h. Ditch 58-C from junction with Ditch 58 to a point approximately 1000 ft. upstream from this junction.

i. Ditch 51-F-7-B from junction with Ditch 51-F-7 to a point 400 ft. upstream from this junction.

j. Ditch 51-F-7-E from junction with Ditch 51-F-7 to a point 800 ft. upstream from this junction.

k. Ditches 59-A-1, 58-M, 51-H and 200-A.

3. Fill as required and regrade to definite drainage ditches the following areas:

a. Area between Ditch 50-B-11 and upper section of Ditch B.

b. Area on each side of upper section of Ditch 51-F-4-D.

c. Area on each side of upper section of Ditch 51-A.

d. Area on each side of upper section of Ditch 51-C-2-B.

e. Area on each side of upper section of Ditch 51-X.

f. Area on each side of Ditch 200.

4. Install system of one-half round invert tile road-side ditches and culverts and roof drains where required in low cost housing area. Complete filling and regrading to these drains.







LEGEND

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

NOTE: Notations in circles thus (C5) refer to subdivisions of section 9 of accompanying report.

SCALE: Approx. 1" = 2400' APPROX

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL HOWARD FIELD, C.Z.	
OFFICE OF THE DEPT. SURGEON RECOMMENDED George W. Hamilton CAPT. SAN. CORPS	APPROVED Wesley C. Roy COL. MED. CORPS
ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER	
AUGUST 1943	DRAWG NO. M.C.-10 HEBYE







NOTE: Notations in circles thus (h3) refer to subdivisions of section 9 of accompanying report.

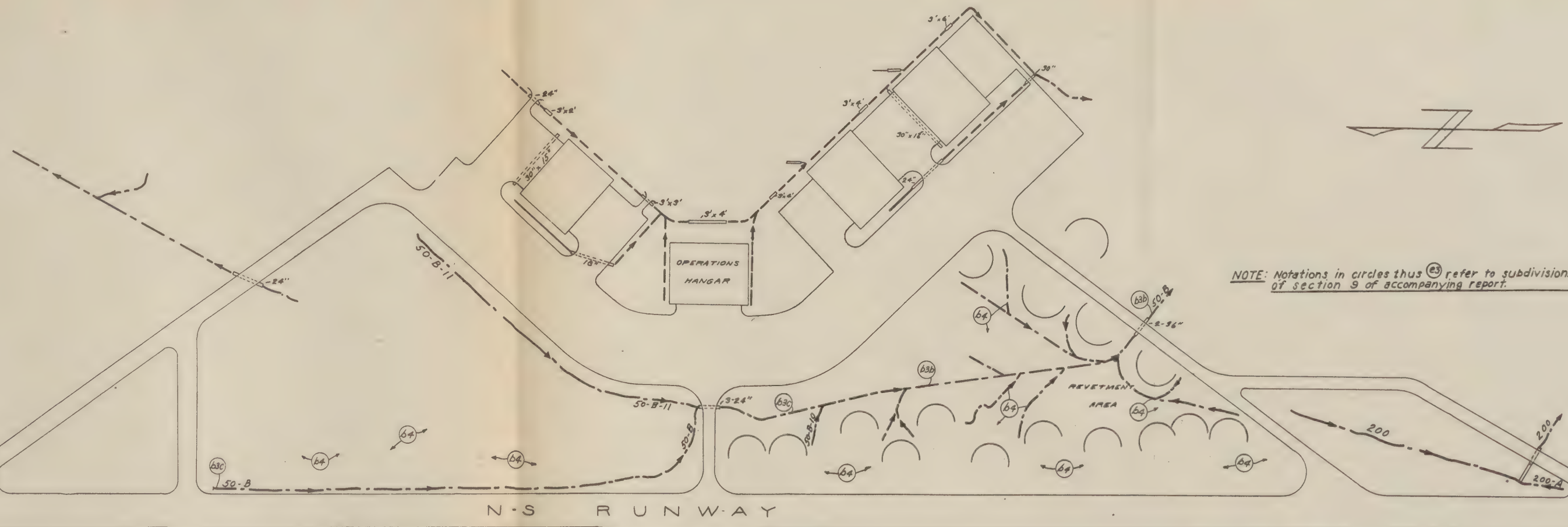
- LEGEND —
- 1/2 ROUND INVERT TILE DITCH
  - FULL CONCRETE DITCH
  - DIRT DITCH
  - CULVERT

SCALE: 1" = 200' APPROX.

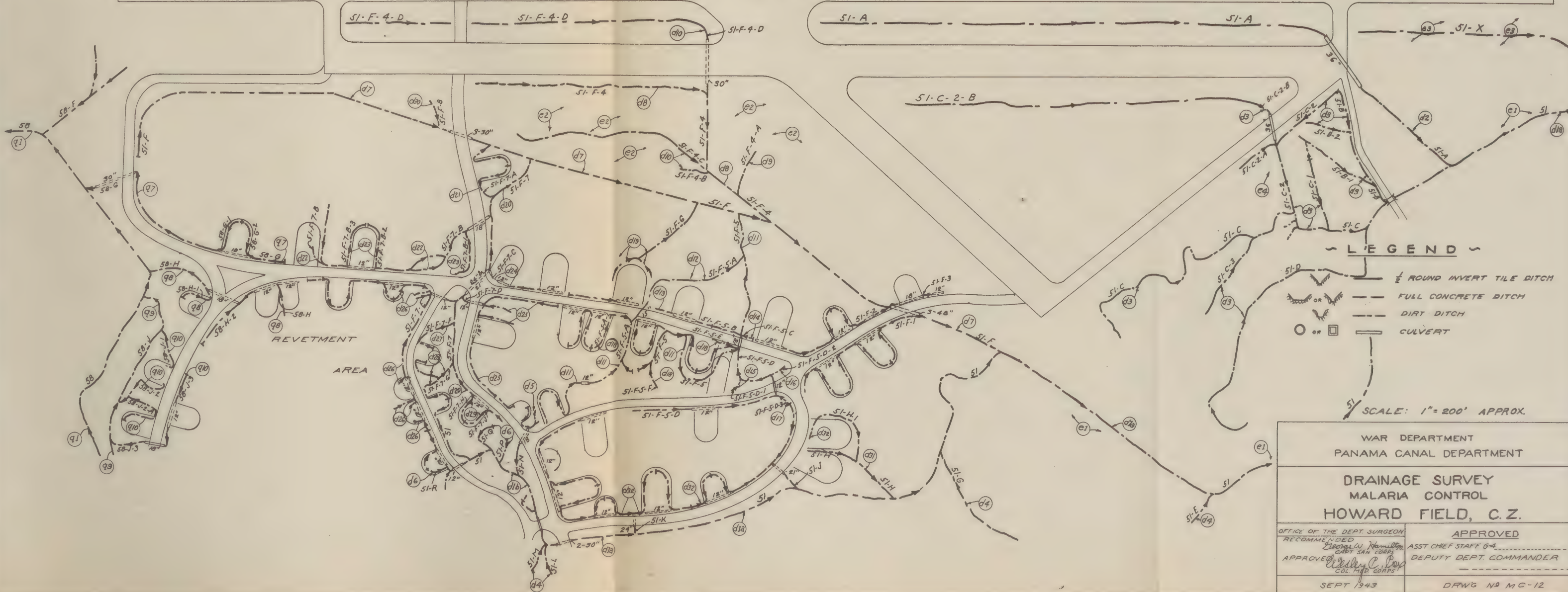
WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL HOWARD FIELD, C.Z.	
OFFICE OF THE DEPT SURGEON RECOMMENDED CAPT SAM. COOPER APPROVED COL. HEB. COOPER	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
SEPT. 1943	DRW'S N3-MC-11







NOTE: Notations in circles thus (e3) refer to subdivisions of section 9 of accompanying report.



~ LEGEND ~

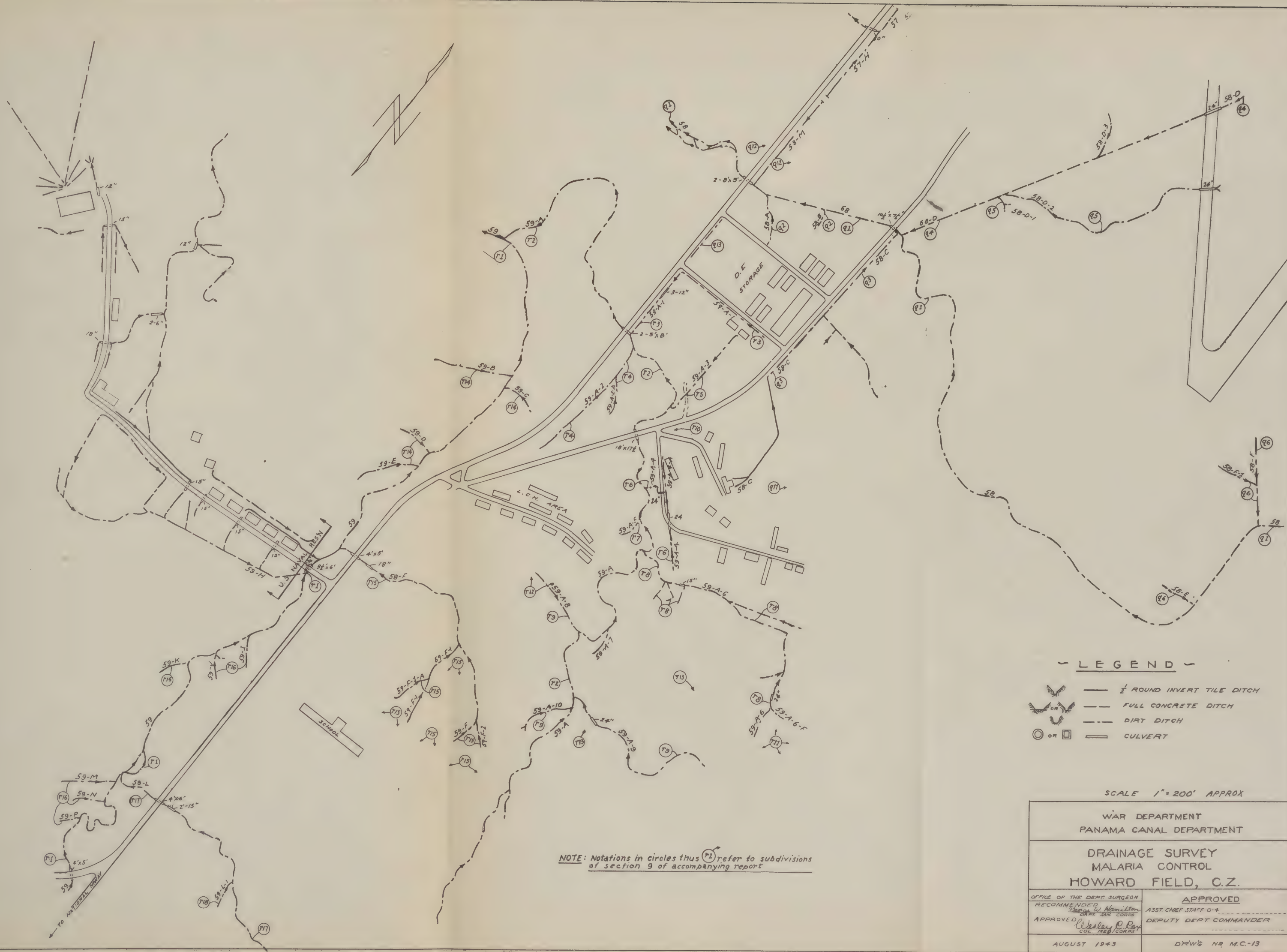
- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

SCALE: 1" = 200' APPROX.

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL HOWARD FIELD, C.Z.	
OFFICE OF THE DEPT. SURGEON RECOMMENDED George W. Hamilton CAPT SAN CORPS	APPROVED ASST CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
SEPT 1943	DRWG NO MC-12




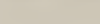






NOTE: Notations in circles thus (P2) refer to subdivisions of section 9 of accompanying report

- LEGEND -

 1/2 ROUND INVERT TILE DITCH  
 FULL CONCRETE DITCH  
 DIRT DITCH  
 CULVERT

SCALE 1" = 200' APPROX

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL HOWARD FIELD, C.Z.	
OFFICE OF THE DEPT. SURGEON RECOMMENDED APPROVED COL. MED. CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
AUGUST 1943	DRAWG NO. M.C.-13





Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps



OUTLYING AREA - VICINITY FT. CLAYTON

AREA NO. 10

Supplementary Report Listing Projects  
Proposed For Construction During  
Fiscal Year 1946

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December 1944





MALARIA CONTROL  
DRAINAGE SURVEYS  
DECEMBER 1944

Supplementary report on Outlying Area- Vicinity of Ft. Clayton (Area No. 10) listing work proposed for construction during the Fiscal Year 1946. Reference Map M.C. 17. Preliminary Estimated Cost \$6300. All work on Army Property.





1. Pave invert and side slopes of Ditch 80 from 36" culvert under Gaillard Highway to junction with Ditch 80-L.
2. Pave invert and side slopes of Ditch 80-K from junction with Ditch 80 to 18" culvert at junction with Ditch 80-K-2.
3. Install 14" one-half round invert tile in following Ditches:
  - a. Ditch 80-E from junction with Ditch 80 to 10" culvert under road to Gun Position.
  - b. Ditches 80-F, 80-G, 80-H and 80-J.
  - c. Ditch 80 from junction with Ditch 80-L to a point 200 ft. upstream from junction with Ditch 80-N.
  - d. Ditch 80-L from junction with Ditch 80 to 18" culvert under road.
  - e. Ditch 80-K-1 from junction with Ditch 80-K to 18" culvert under road.
  - f. Ditch 42-G.







— LEGEND —

-  1/2 ROUND INVERT TILE DITCH
-  FULL CONCRETE DITCH
-  DIRT DITCH
-  24" CULVERT

FORT CLAYTON  
(NEW POST)

ORDNANCE  
AREA

MIRAFLORES  
FILTRATION PLANT

STORAGE TANKS

FIRST AID  
STATION

GAILLARD HIGHWAY

MIRAFLORES  
LAKE

SCALE: 1"=200' APPROX.

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
OUTLYING AREA-VICINITY OF FT. CLAYTON

OFFICE OF THE DEPT SURGEON  
RECOMMENDED *W. Hamilton*  
CAPT. USA  
APPROVED *W. Hamilton*  
COL. USA

APPROVED  
ASST. CHIEF STAFF G-4  
DEPUTY DEPT. COMMANDER

NOV. 1943

DRWG NM MC-17

NOTE: Notations in circles thus (b2) refer to subdivisions of section 13 of accompanying report.



Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps





MALARIA CONTROL - DRAINAGE SURVEYS

FT. DAVIS - AREA NO. 11

Supplementary Report Listing Projects .  
Proposed For Construction During  
Fiscal Year 1946

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December 1944





MALARIA CONTROL  
DRAINAGE SURVEYS  
DECEMBER 1944

Supplementary report on Ft. Davis (Area No. 11), listing work proposed for construction during the Fiscal Year 1946. Reference Maps M.C. 18 and M.C. 19. Preliminary Estimated Cost: Work on Army Property \$37,300; work on Panamá Canal Property \$8,000; Total Cost \$45,300.

1. Pave invert and side slopes of following Ditches:

a. Ditch 96 from Naval Radio Station fence line near junction with Ditch 96-J to 7' x 15' culvert at junction with Ditch 96-Q.

b. Ditch 96 from junction with Ditch 96-R to a point 600 ft. upstream from this junction.

c. Ditch 96-R from junction with Ditch 96 to a point 600 ft. upstream from this junction.

d. Ditch 97 from junction with Ditch 97-V to 7' x 9' culvert under relocated Panama Railroad near junction with Ditch 97-X.

e. Ditch 97 from 8' x 7½' culvert under relocated Panama Railroad just upstream from junction with Ditch 97-BB to junction with Ditch 97-JJ.

f. Ditch 97 from 7' x 9' culvert under relocated Panama Railroad to 8' x 7½' culvert under relocated Panama Railroad (Panama Canal Property).

g. Ditch 97-F-14 from a point 200 ft. upstream from junction with Ditch 97-F-14-C to a point 1000 ft. upstream from this junction.

2. Install 14" one-half round invert tile laid to maximum practicable grade in following Ditches:

a. Ditch 97-CC from junction with Ditch 97 to a point 300 ft. upstream from this junction.

b. Ditch 97-DD from junction with Ditch 97 to a point 400 ft. upstream from this junction.

c. Ditches 97-EE, 97-FF and 97-HH from junction with Ditch 97 to culverts under relocated Panama Railroad.

d. Ditch 97-GG from junction with Ditch 97 to a point 500 ft. upstream from this junction.

e. Ditch 97-Y (Panama Canal Property).

f. Ditch 97-BB from junction with Ditch 97 to 36" culvert under relocated Panama Railroad. ( Panama Canal Property).





— LEGEND —

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

NOTE: Notations in circles thus (d8) refer to subdivisions of section 14 of accompanying report.  
SCALE: 1" = 200' (Approx.)

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
FORT DAVIS, C.Z.

OFFICE OF THE DEPT. SURGEON RECOMMENDED: <i>Walter C. Roy</i> APPROVED: <i>Walter C. Roy</i> NOV, 1943	APPROVED ASST CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER DRAW'G NO MC-19
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Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps



MALARIA CONTROL - DRAINAGE SURVEYS

FT. GULICK - AREA No. 13

Supplementary Report Listing Projects  
Proposed For Construction During  
Fiscal Year 1946

---

December 1944





MALARIA CONTROL  
DRAINAGE SURVEYS  
DECEMBER 1944

Supplementary report on Ft. Gulick (Area No. 13), listing work proposed for construction during the Fiscal Year 1946. Reference Maps M.C. 21 and M.C. 22. Preliminary Estimated Costs: Army Property \$45,400; Panama Canal Property \$28,000; Total Cost \$73,400.

1. Pave invert and side slopes of following Ditches:

- a. Ditch 115 from Panama Canal property line (near junction with Ditch 115-K) to junction with Ditch 115-X.
- b. Ditch 115-J from Panama Canal property line (near junction with 115-J-2) to junction with 115-J-4.
- c. Ditch 115-M from Ditch 115 to junction with Ditch 115-M-4.
- d. Ditch 115-M-1 from junction with Ditch 115-M to junction with Ditch 115-M-1-A.
- e. Ditch 115-N from junction with Ditch 115 to culvert under Gulick-France Field Road.
- f. Ditch 115-V from junction with Ditch 115 to existing paved section along Gulick access road.
- g. Ditch 116-Q from junction with Ditch 116 to 18" culvert under highway.
- h. Ditch 115-C from junction with Ditch 115 to junction with Ditch 115-C-3 (Panama Canal Property).
- i. Ditch 115-D from junction with Ditch 115 to junction with Ditch 115-D-1 (Panama Canal Property).
- j. Ditch 115-F from junction with Ditch 115 to junction with 115-F-2 (Panama Canal Property).
- k. Ditch 115-L from junction with Ditch 115 to Army-Panama Canal property line (Panama Canal Property).
- l. Ditch 115-J from junction with Ditch 115 to Army-Panama Canal property line (Panama Canal Property).

2. Install 14" one-half round invert tile laid to maximum practicable grade in following Ditches:

- a. Ditches 115-J-2, 115-J-3 and 115-J-4.
- b. Ditch 115-M-1 from junction with Ditch 115-M-1-A to end.
- c. Ditches 115-M-1-A, 115-M-1-B, 115-M-2, 115-M-2-A, 115-M-3 and 115-M-4.
- d. Ditch 115-M from junction with Ditch 115-M-4 to end.
- e. Ditch 115-P from junction with Ditch 115 to a point 150 ft. upstream from this junction.
- f. Ditches 115-Q, 115-R, 115-S, 115-U, 115-W, 115-U-1, 115-U-2, 115-W-1 and 115-X.
- g. Ditches 116-AA and 116-S.
- h. Ditch 116-R from junction with Ditch 116-R-1 to end.
- i. Ditches 117 and 118.
- j. Ditch 115-B from junction with Ditch 115 to junction with Ditch 115-B-1 (Panama Canal Property).
- k. Ditch 115-D from junction with Ditch 115-D-1 to end (Panama Canal Property).
- l. Ditches 115-D-1, 115-C-1 and 115-C-2 (Panama Canal Property).
- m. Ditches 115-E, 115-F-1 and 115-F-2 (Panama Canal Property).
- n. Ditches 115-G and 115-G-1 (Panama Canal Property).
- o. Ditches 115-H and 115-H-1-A (Panama Canal Property).
- p. Ditch 115-H-1 from junction with Ditch 115-H to a point 50 feet upstream from junction with Ditch 115-H-1-A (Panama Canal Property).
- q. Ditch 115-F upstream from junction with Ditch 115-F-2 (Panama Canal Prop).
- r. Ditch 115-K (Panama Canal Property).

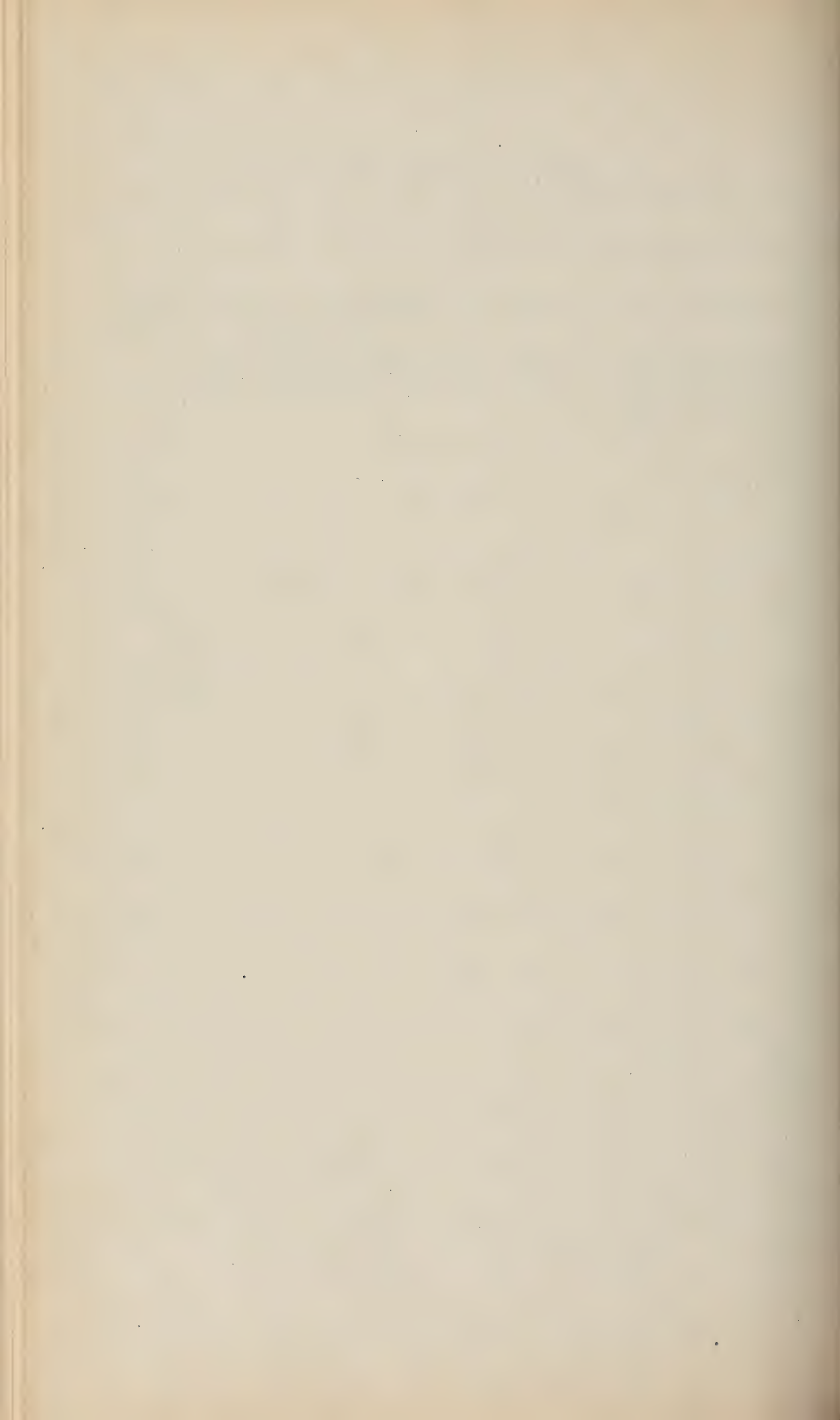


s. Ditch 115-Y from junction with Ditch 115 to end (Panama Canal Property).

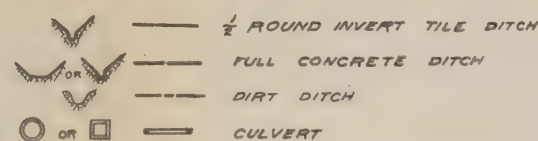
t. Ditch 115-Z from junction with Ditch 115 to end (Panama Canal Property).

u. Ditch 115-AA from junction with Ditch 115 to a point 500 ft. upstream from this junction (Panama Canal Property)

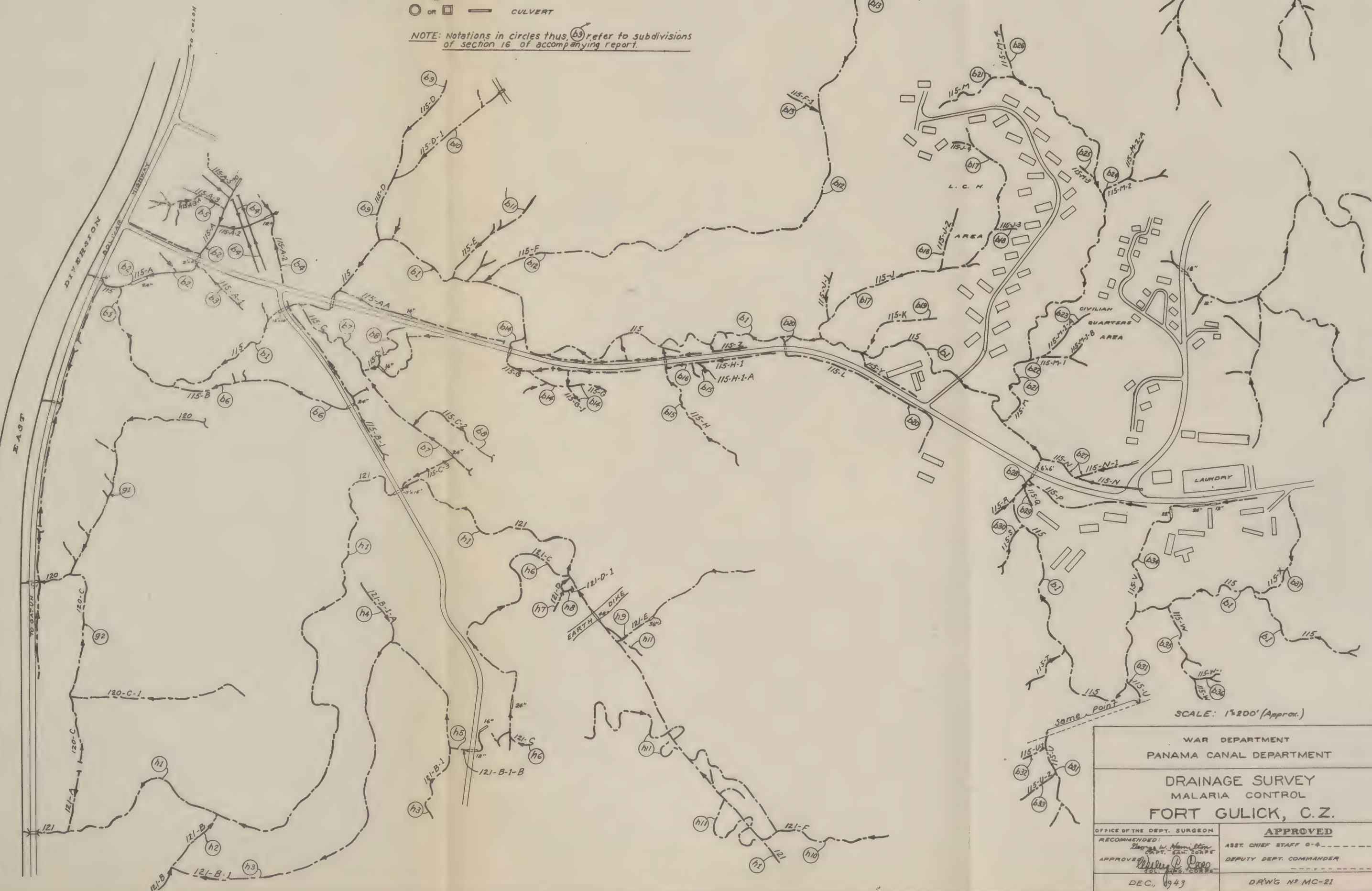
3. Pave side slopes of Ditch 115-A from junction with Ditch 115 to 30" culvert near junction with Ditch 115-A-5. Remove or reset 24" culvert at Navy pipe line crossing (Panama Canal Property).



# ~ LEGEND ~



NOTE: Notations in circles thus (63) refer to subdivisions of section 16 of accompanying report.



SCALE: 1"=200' (Approx.)

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
FORT GULICK, C.Z.

OFFICE OF THE DEPT. SURGEON

RECOMMENDED:

APPROVED:

DEC. 1943

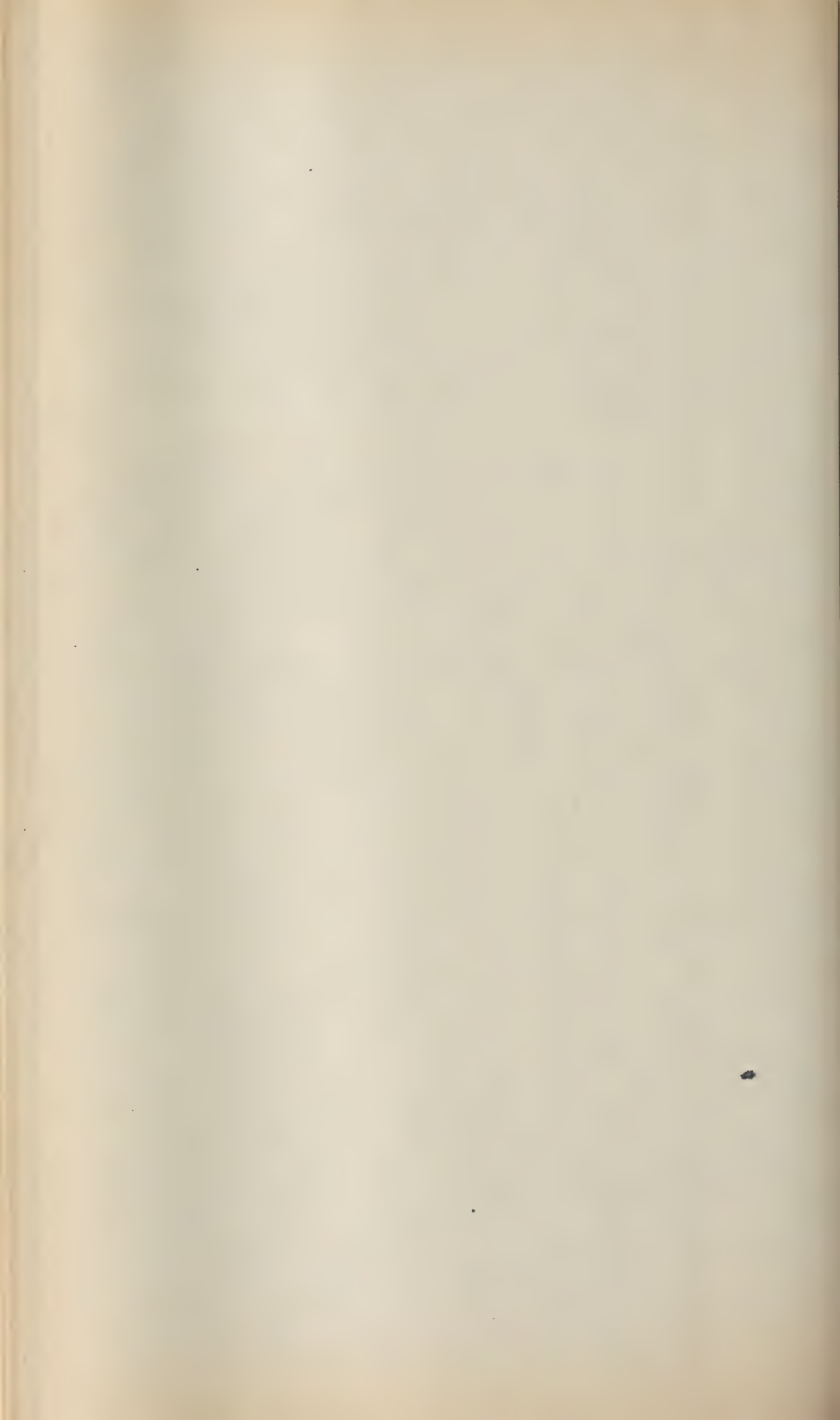
APPROVED

ASST. CHIEF STAFF G-4

DEPUTY DEPT. COMMANDER

DRAWG NO MC-21











Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps.



MALARIA CONTROL - DRAINAGE SURVEYS

FRANCE FIELD - AREA NO. 14

Supplementary Report Listing Property  
Proposed For Construction During  
Fiscal Year 1946

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December 1944

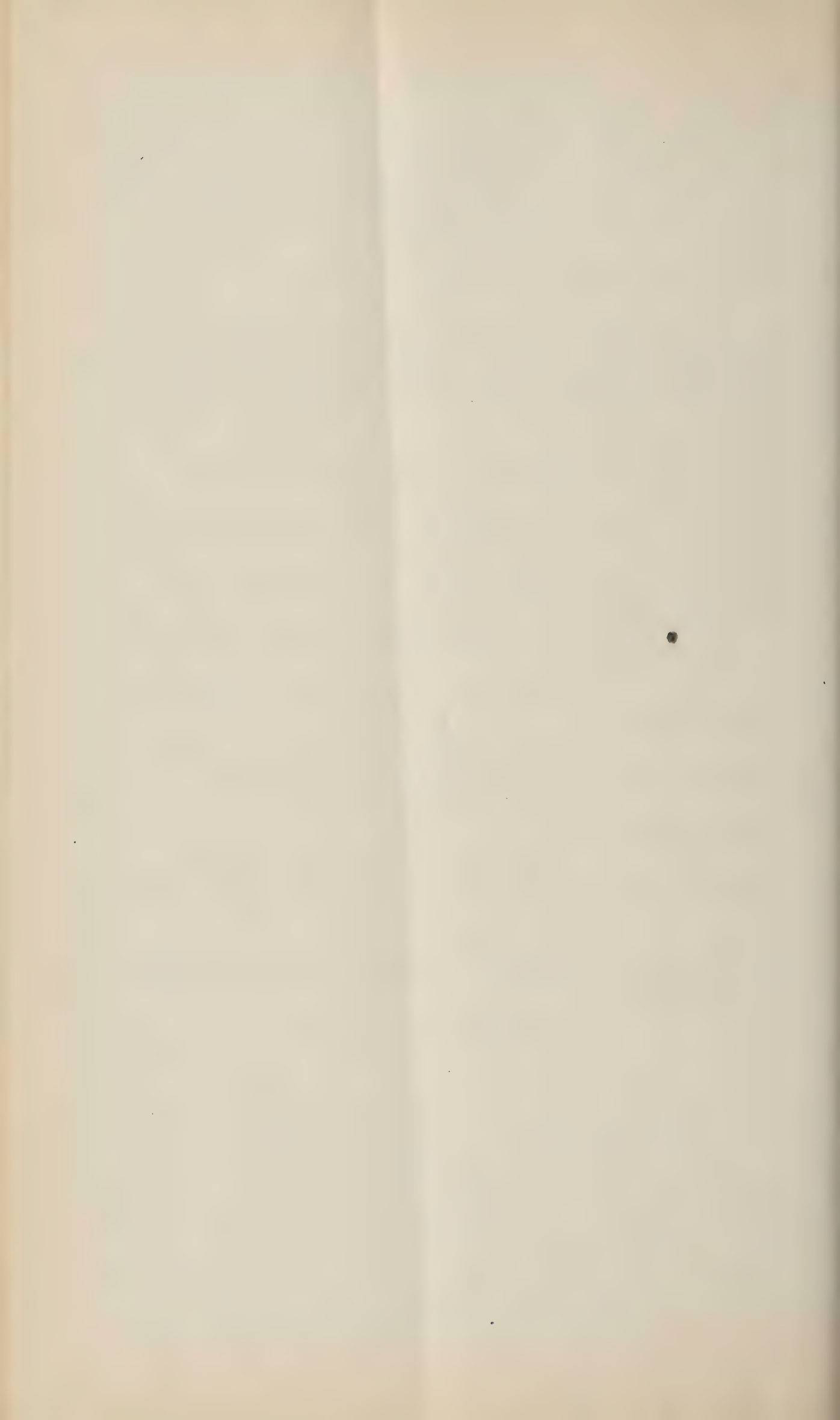




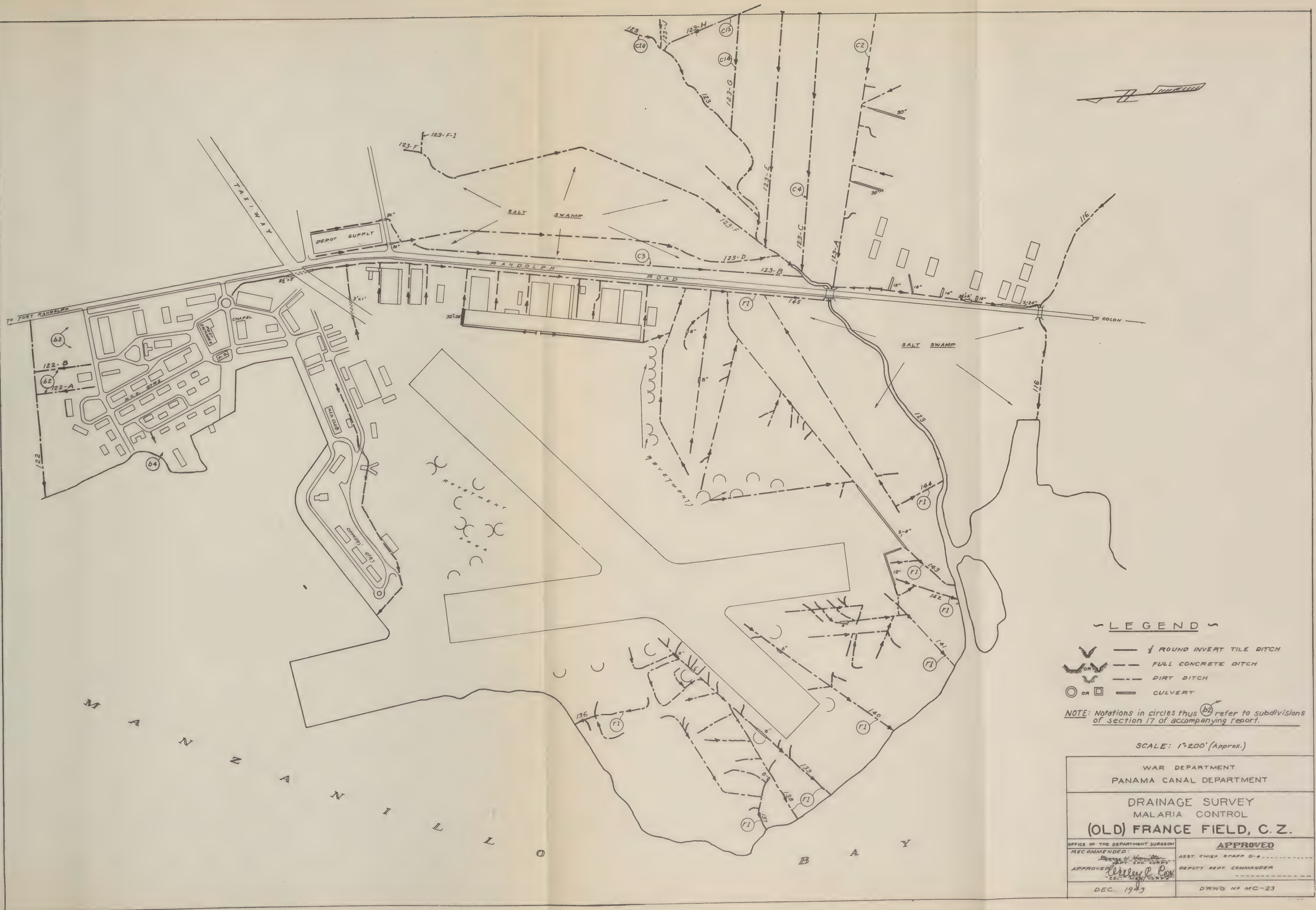
MALARIA CONTROL  
DRAINAGE SURVEYS  
DECEMBER 1944

Supplementary report on France Field (Area No. 14), listing work proposed for construction during the Fiscal Year 1946. Reference Maps M.C. 23, M.C. 24, M.C. 25 and M.C. 26. Preliminary Estimated Cost \$28,600. All work on Army Property.

1. Pave invert and side slopes of following Ditches:
  - a. Ditch 134 from inlet to 60" culvert near junction with Ditch 134-D to junction with Ditch 134-E.
  - b. Ditch 134-E from junction with Ditch 134 to 24" culvert under By-Pass Road.
  - c. Ditch 132-A from junction with Ditch 134 to 24" culvert under taxiway.
  - d. Ditch 131 from junction with Coco Solo River to 24" culvert under runway.
2. Install 14" one-half round invert tile in following Ditches:
  - a. In ditches tributary to Ditch 123 for section between junctions of this Ditch with Ditch 123-P and 123-Q.
  - b. Ditches 123-S-1 and 123-S to Panama Canal Property Line.
  - c. Ditches 122-J-2, 122-J-3, 122-J-3-A, 122-M, 122-N, 122-P-2, 122-S and 122-T.
  - d. Ditch 127-B-1-A.
  - e. Ditch 122-D from junction with Ditch 122-D-8 to junction with Ditch 122-D-9.
  - f. Ditch 123-M-1.
  - g. Ditch 122-D-12.

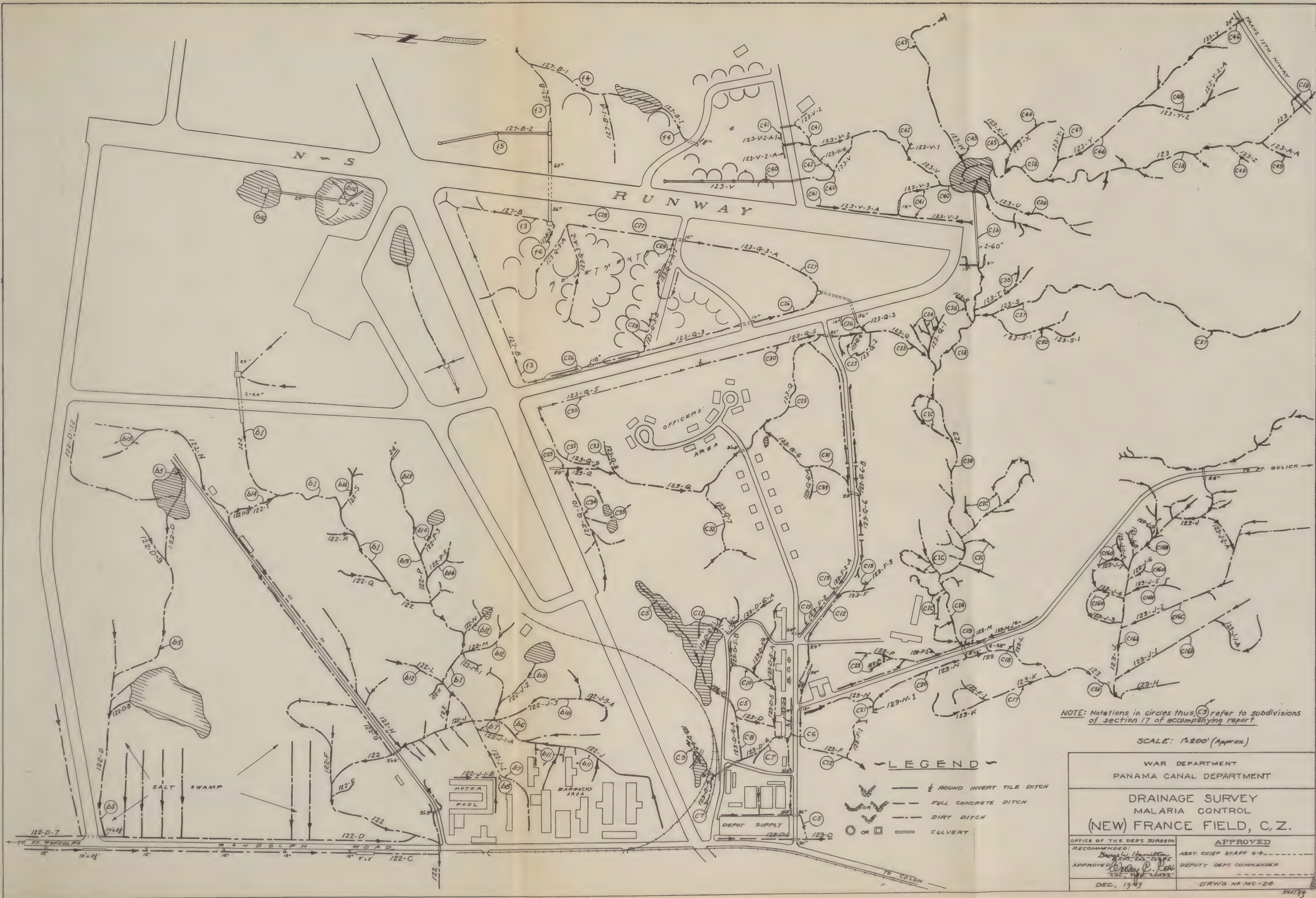












NOTE: Notations in circles thus, C3 refer to subdivisions of section 17 of accompanying report.

SCALE: 1"=200' (Approx.)

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
(NEW) FRANCE FIELD, C.Z.

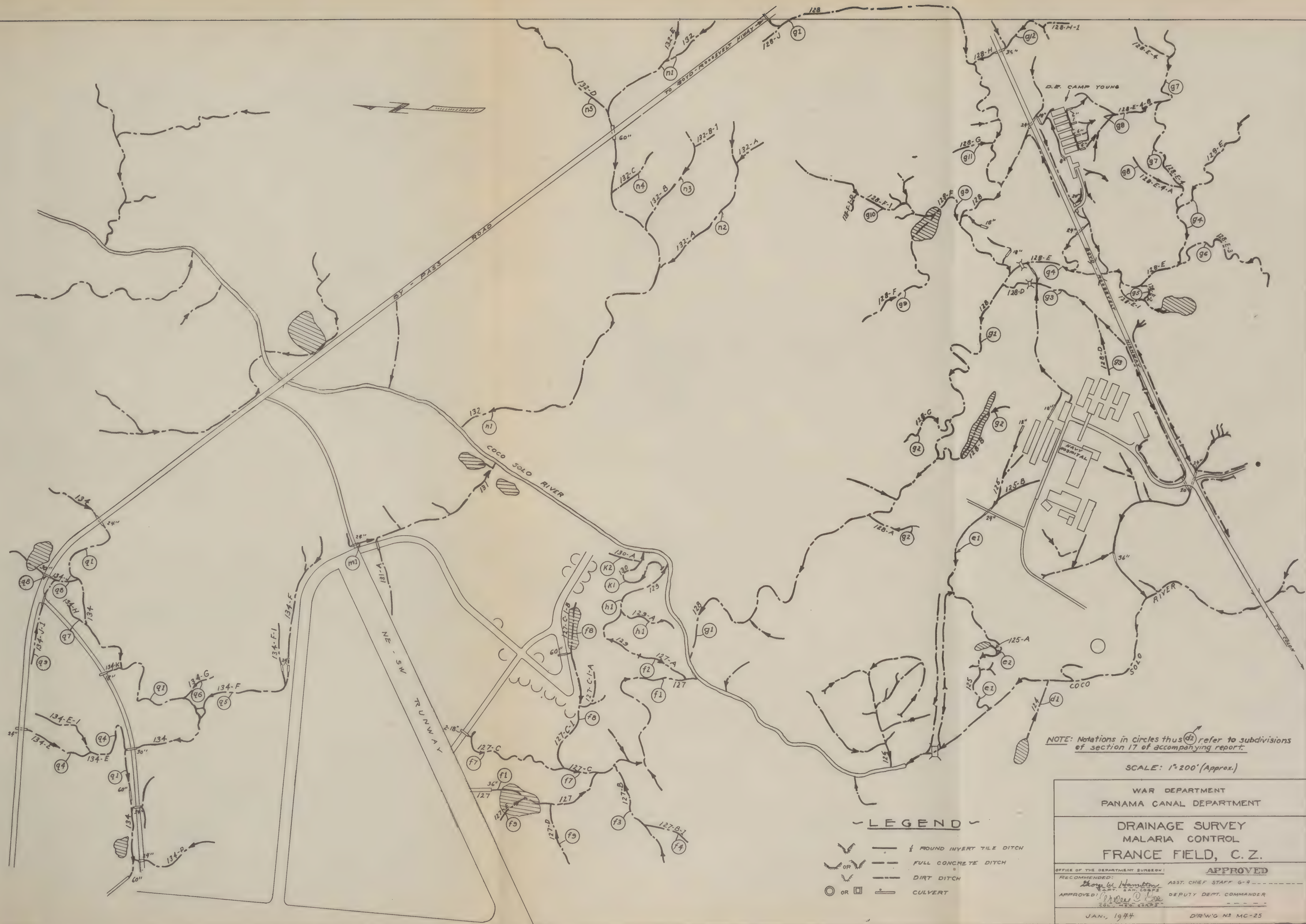
OFFICE OF THE DEPT SURGEON RECOMMENDED: <i>Charles W. Hamilton</i> APPROVED: <i>Orson P. Reed</i> COL, FIVE CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
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DEC., 1943

DRAWING NO MC-24







NOTE: Notations in Circles thus (d2) refer to subdivisions of section 17 of accompanying report.

SCALE: 1"=200' (Approx.)

### LEGEND

- ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

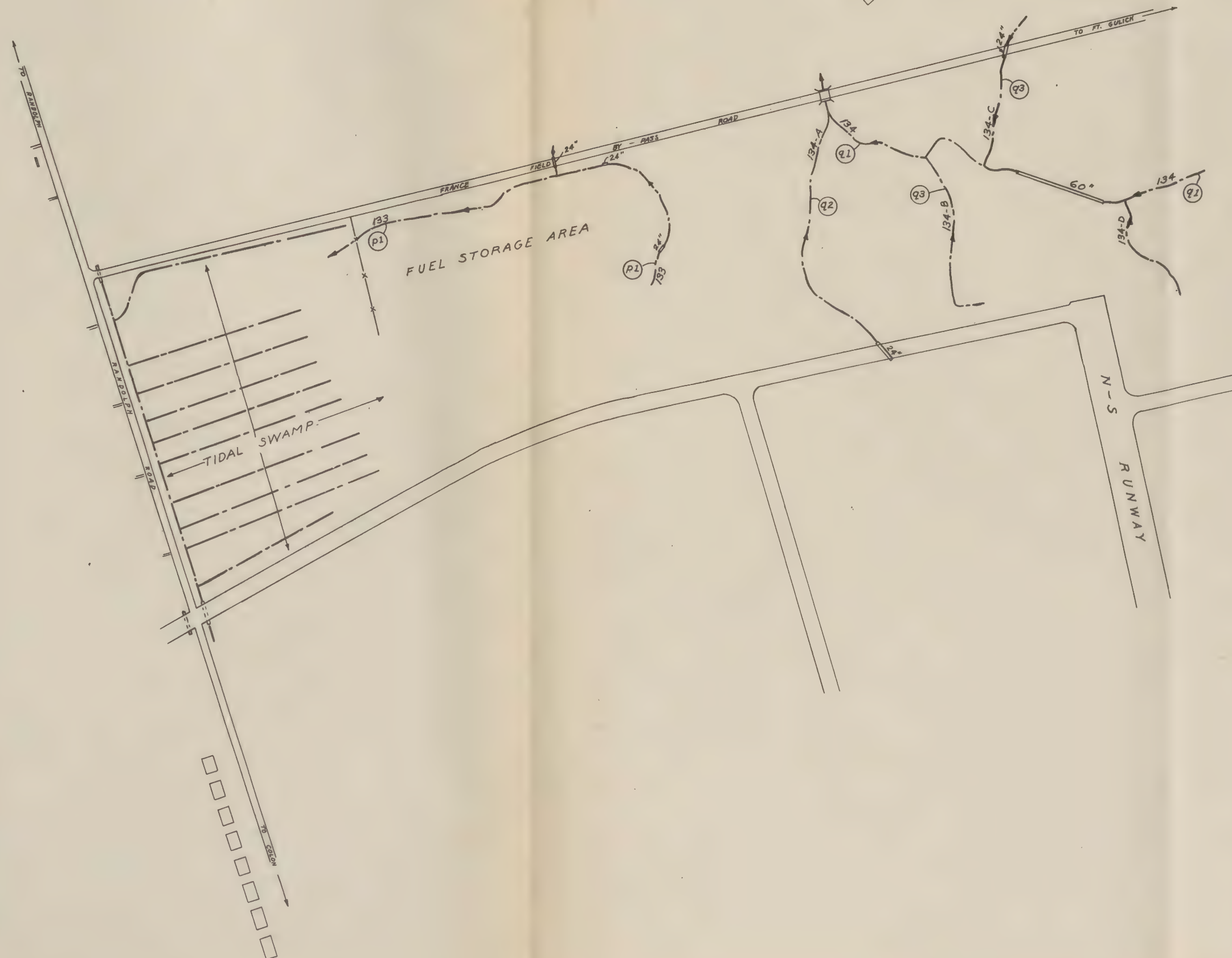
WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL FRANCE FIELD, C.Z.	
OFFICE OF THE DEPARTMENT SURGEON RECOMMENDED: <i>Thompson Hamilton</i> APPROVED: <i>[Signature]</i> COL, MED CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER JAN., 1974 DIR/WG NO MC-25





COCO SOLO NAVAL

RESERVATION



NOTE: Notations in Circles thus (P1) refer to subdivisions of section 17 of accompanying report

# LEGEND

- 1/2" ROUND INVERT TIE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

SCALE: 1"=200' (Approx.)

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL FRANCE FIELD, C.Z.	
OFFICE OF THE DEPARTMENT SURGEON RECOMMENDED: <i>Donald W. Hamilton</i> APPROVED: <i>Charles P. Ross</i> FEB., 1944	APPROVED ASST. CHIEF STAFF O-4 DEPUTY DEPT. COMMANDER D'H'W'G NR MC-26



Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps





MALARIA CONTROL - DRAINAGE SURVEYS

FT. SHERMAN - AREA NO. 18

Supplementary Report Listing Projects  
Proposed For Construction During  
Fiscal Year 1946

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December 1944





MALARIA CONTROL  
DRAINAGE SURVEYS  
DECEMBER 1944

Supplementary report on Ft. Sherman (Area No. 18) listing work proposed for construction during the Fiscal Year 1946. Reference Maps M.C. 33 and M.C. 34. Preliminary Estimated Cost \$27,500. All work on Army Property.

1. Pave invert and side slopes of following Ditches:
  - a. Ditch 155 from junction with Ditch 155-D to junction with Ditch 155-G.
  - b. Ditch 158-G from junction with Ditch 158 to junction with Ditch 158-G-4.
  - c. Ditch 155-F from junction with Ditch 155 to end.
2. Pave side slopes of following Ditches whose inverts are already paved;
  - a. Ditch 155 from a point 100 ft. downstream from junction with Ditch 155-C to junction with Ditch 155-D.
  - b. Ditch 155-C.
3. Install 14" one-half round invert tile in following Ditches:
  - a. Ditch 152 from a point 200 ft. from outlet point to culvert under road.
  - b. Ditches 155-D, 155-E and 155-G.
  - c. Ditch 159 for the 500 ft. unpaved section between existing lower and upper paved sections.
  - d. Ditch 160-M for the 500 ft. unpaved upper section.
  - e. Ditch 160-C from junction with Ditch 160-C-3 to end.
  - f. Ditch 160-X from upper end to a point of definite outlet.
  - g. Uncompleted roof drain outlets for New Barracks.

h. Ditch 161-C from junction with Ditch 161-C-1 to a point 200 ft. upstream from junction with Ditch 161-C-4.

i. Ditches 161-C-4 and indicated tributaries.

j. Ditch 160-F from junction with Ditch 160 to junction with Ditch 160-F-3.

k. Ditch 160-N-1 for the 200 ft. unpaved upper section.

l. Ditches 158-G-1, 158-G-2, 158-G-4 and 158-G-5.

m. Ditch 158-G from junction with Ditch 158-G-4 to end.

n. Ditches 158-G-3-A and 158-G-3-A-1.

o. Ditches tributary to Ditch 158-G for section of this Ditch between junctions with Ditches 158-G-3 and 158-G-4.

p. Ditch 155 upstream from junction with Ditch 155-G.

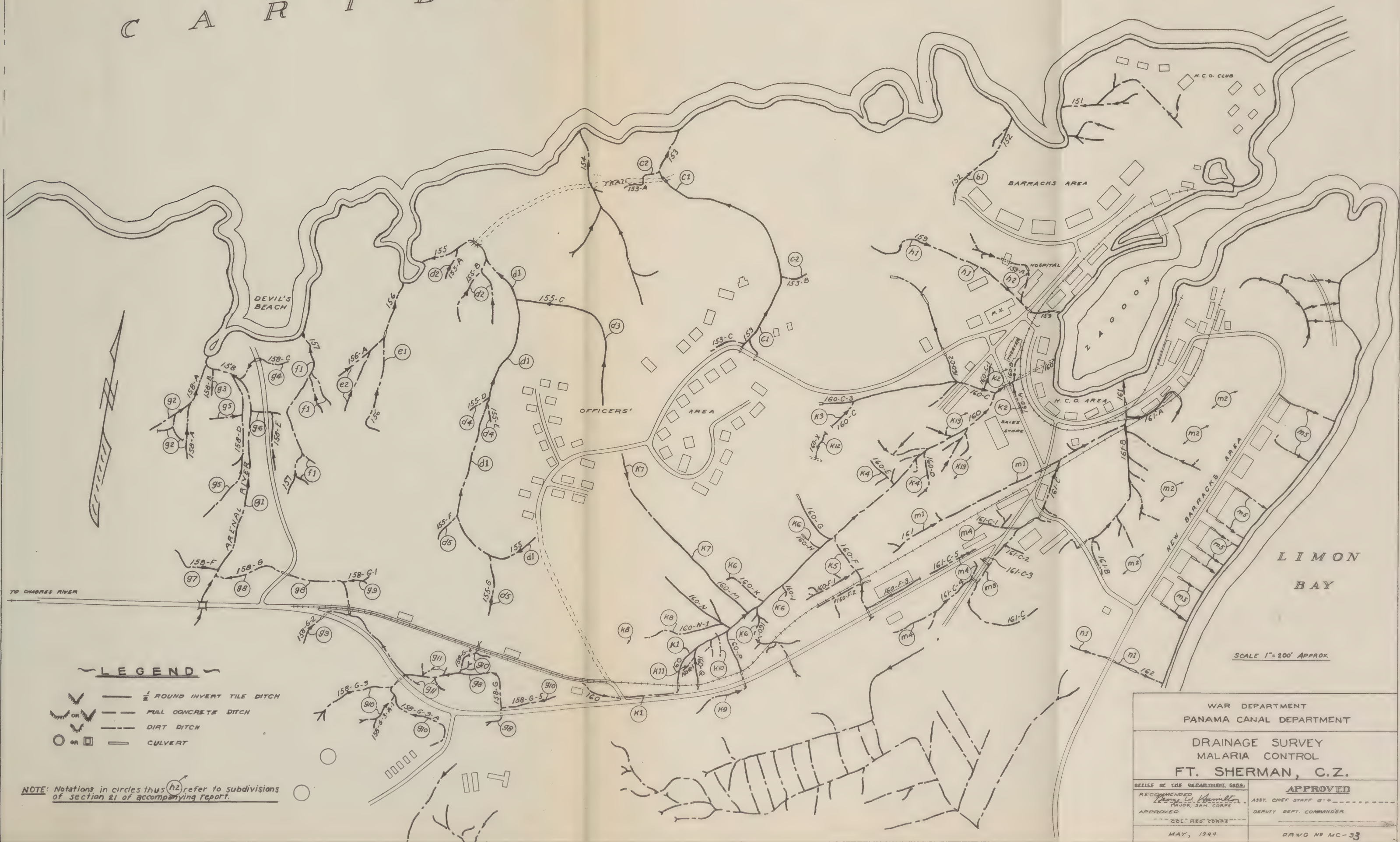
4. Fill large excavation hole in rear of sewage pumping station serving the non-commissioned officers' area.

5. Fill numerous bell holes in newly constructed water main parallel to upper section of Ditch 164-C.

6. Regrade, install inlet boxes and 14" one-half round invert tile in area in front of New Barracks.



# C A R I B B E A N S E A



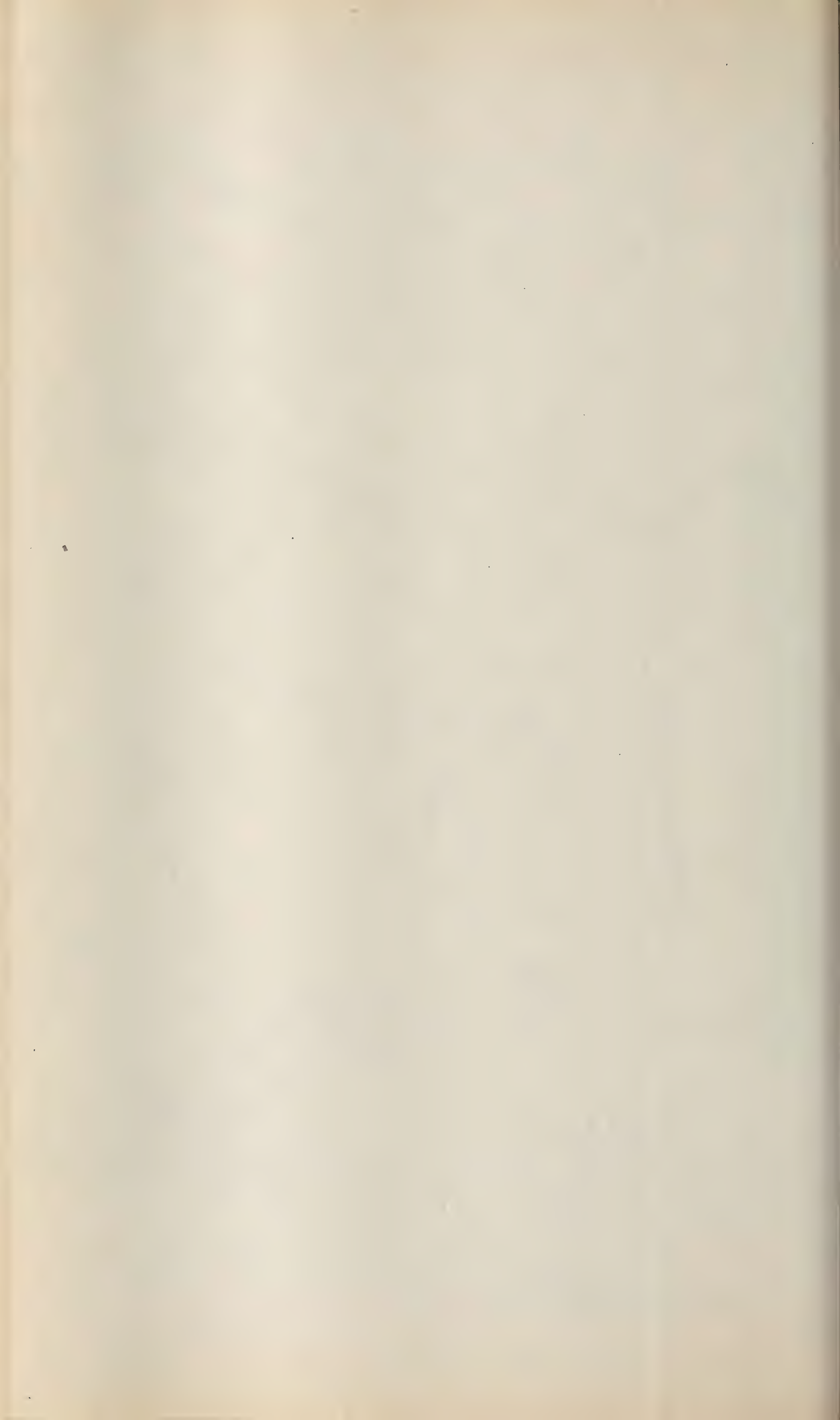
## LEGEND

- ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

NOTE: Notations in circles thus (h2) refer to subdivisions of section 21 of accompanying report.

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL FT. SHERMAN, C.Z.	
OFFICE OF THE DEPARTMENT SSG.	APPROVED
RECOMMENDED By <i>Wm. C. Hamilton</i> TRIGR. SAN. CORPS	ASST. CHIEF STAFF G-4
APPROVED By <i>Wm. C. Hamilton</i> COL. MED. CORPS	DEPUTY DEPT. COMMANDER
MAY, 1944	DAWG NO MC-33







# LEGEND

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- or □ CULVERT

NOTE: Notations in circles thus (P2) refer to subdivisions of section 21 of accompanying report.

SCALE 1"=200' APPROX

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL FT. SHERMAN, C.Z.	
OFFICE OF THE DEPARTMENT BOARD. RECOMMENDED: James L. Hamilton MAJOR SAN CORPS	ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
APPROVED: COL. MED CORPS	
MAY, 1944	DRVG. NO MC-34





Recommended George W. Hamilton  
Major, Sanitary Corps

Approved Wesley C. Cox  
Colonel, Medical Corps



EXHIBIT C





MALARIA CONTROL - DRAINAGE SURVEYS

Supplementary Report Listing Projects  
Proposed for Construction During Fiscal  
Year 1945





MALARIA CONTROL - DRAINAGE SURVEYS

REVISED REPORT COVERING  
COROZAL - AREA NUMBER ONE



## MALARIA CONTROL

### DRAINAGE SURVEYS

AUGUST 1944

Revised report on Corozal (Area Number One) listing work for inclusion in the \$400,000 Malaria Control Project (F.Y. 1945). Reference Maps M.C. 1, and M.C. 2, attached hereto. Preliminary estimated cost \$10,000.

1. Pave side slopes of Ditch 1 from junction with Ditch 1-N to junction with Ditch 1-Q. Height of side slopes to be 24 inches.

2. Install  $\frac{1}{2}$  round invert tile and 24 inch concrete side slopes in Ditch 7 from Panama Canal to junction with Ditch 7-A.

3. Straighten and pave invert and side slopes of Ditch 10 from Panama Canal to the 42x5' culvert under railroad spur track. Remove 36" culvert at bank to Canal. Install new corrugated metal or concrete pipe culvert under road to dump yard. Connect Ditch 10-A to relocated Ditch 10 with  $\frac{1}{2}$  round invert tile. Install  $\frac{1}{2}$  round invert tile in Ditch 10-A-1. Backfill abandoned section of channel to insure complete drainage. Install  $\frac{1}{2}$  round invert tile along south toe of dump yard fill for 400 feet from Canal.

(Alternate for Item 3) Relocate Ditch 10 to its former location along south toe of dump yard fill and pave invert and side slopes from Canal to 4.2x5' culvert under railroad spur track. Backfill existing channel for complete drainage.

4. Pave side slopes of Ditch 5-L-11 from junction with Ditch 5-L to a point 300 feet upstream from this junction. Side slopes to be 12" width concrete.

5. Pave side slopes of Ditch 9-N from junction with Ditch 9 to end. Side slopes to be 12" width.

6. Fill ruts, holes, etc., incident to construction of previous items.





Recommended \_\_\_\_\_  
Major, Sanitary Corps

Approved \_\_\_\_\_  
Colonel, Medical Corps













### ~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT
- TILE DITCH

NOTE: Notations in circles thus <sup>or</sup> refer to subdivisions of section 4 of accompanying report.

SCALE: Approx. 1:2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
COROZAL C.Z.

OFFICE OF THE DEPT. SURGEON

RECOMMENDED *George W. Hamilton*

APPROVED *William C. Roy*

COL, MED CORPS

APPROVED

ASST. CHIEF STAFF G-4

DEPUTY DEPT. COMMANDER

JUNE 1943

DRWG N° MC 2





MALARIA CONTROL - DRAINAGE SURVEYS

REVISED REPORT COVERING  
ALBROOK FIELD - AREA NUMBER THREE





MALARIA CONTROL

DRAINAGE SURVEYS

AUGUST 1944

Revised report on Albrook Field (Area Number Three) listing work for inclusion in the \$400,000 Malaria Control Project (F.Y. 1945). Reference Maps M.C. 4, M.C. 5, and M.C. 6, attached hereto. Preliminary estimated cost \$86,500.

1. Pave invert and side slopes of following ditches:

(a) Ditch 11 from a point 100 feet downstream from junction with Ditch 11-H to outlet of 12x7' culvert under north end of runway.

(b) Ditch 11 from inlet to 12x7' culvert under north end of runway to a point 350' downstream from 6x7' culvert under highway near junction with Ditch 11-T.

(c) Ditch 11 from inlet of 6x7' culvert under highway near junction with 11-T to 5x6' culvert at junction with Ditch 11-Y.

(d) Ditch 11-C from junction with Ditch 11 to 24" culvert at junction with Ditch 11-C-5.

(e) Ditch 11-G from a point 200 feet downstream from 39" culvert (located about 250 feet downstream from junction with Ditch 11-G-9) to junction with Ditch 11-G-12.

(f) Ditch 11-G-10 from junction with Ditch 11-G to 24" culvert at junction with Ditch 11-G-10-B.

(g) Ditch 11-L from junction with Ditch 11-L-3 to junction with Ditch 11-L-11.

(h) Ditch 11-P from junction with Ditch 11 to a point 50 feet upstream from junction with Ditch 11-P-2.

(i) Ditch 11-Z from junction with Ditch 11 to 4x4' culvert at junction with 11-Z-6.

Above ditches to be straightened where required to remove abrupt changes in direction and abandoned sections of channels to be backfilled to insure complete drainage. Adjacent banks to be regraded where required to drain to paved ditches. Inverts of ditches may be 14" or larger precast concrete tile or may be monolithic concrete slightly pitched to the center. Side slopes may be precast or monolithic concrete provided where required with frequent weepholes.

2. Pave side slopes of following Ditches: (Existing inverts are paved.)

(a) Ditch 11 from a point 350 feet downstream from 6x7' culvert under highway (near junction with Ditch 11-T) to outlet of this 6x7' culvert.

(b) Ditch 11-G from two 24" culverts at junction with 11-G-5 to a point 200 feet downstream from 39" culvert (located about 250 feet downstream from junction with Ditch 11-G-9).

(c) Ditch 11-G-12 from junction with Ditch 11-G to 36" culvert at junction with Ditch 11-G-12-B.

(d) Ditch 11-E from junction with Ditch 11 to junction with Ditch 11-E-1.

(e) Ditch 11-Z-3 from junction with 11-Z to junction with Ditch 11-Z-3-A.

(f) Ditch 11-L from junction with Ditch to junction with 11-L-3.

3. Establish uniform grade in and remove obstructions and debris from Ditch 11 from 6½x7' culvert (located about 200 feet upstream from junction with Ditch 11-G) to a point 100 feet downstream with Ditch 11-H.

4. Remove two 24" culverts in Ditch 11-G at junction with 11-G-5 which are now set 12" higher than incoming ditch 11-G. Replace with 48" diameter pipe properly graded to box culvert under ball diamond. If subsequent investigations indicate that these two 24" culverts were purposely inserted to lessen flood hazards further downstream they may be lowered only instead of replacing with 48" diameter culvert.

5. Fill area in triangle between Ditches 12-G and 12-G-4 to the minimum depth required to drain it into a new  $\frac{1}{2}$  round invert tile ditch draining into Ditch 12-G-4 and extending to upper end of fill. Install 12"  $\frac{1}{2}$  round invert tile through center.

6. Regrade area in triangle between Ditches 11-G and 11-G-6.

7. Complete minor regrading and filling jobs in the three former revetment areas, and other low spots in runway areas.

8. Install 14"  $\frac{1}{2}$  round invert tile laid to maximum practicable grade in following Ditches:

(a) Ditches 11-G-5 and tributaries.

(b) Ditches 11-G-10-A from junction with Ditch 11-G-10 to junction with Ditch 11-G-10-A-1 including the short tributaries to this section.

(c) Ditch 11-G-10-A-1 from junction with Ditch 11-G-10-A to culvert under Albrook School road.

(d) Ditches 11-G-20 and 11-G-21 including the part of their tributaries indicated on Map M.C. 4.

(e) Ditches 11-C-4, 11-H, 11-J, and 11-K, from main Ditches to first culverts in each of these laterals.

(f) Ditches 11-L-3, 11-L-4, 11-L-5, 11-L-8, and 11-L-9, from junctions with 11-L to first culverts in each of these laterals.

(g) Ditch 11-G-11-A from junction with sewer 11-G-11 to existing pipe outlet.

9. Recondition end of Ditch 11-G-7 at junction with Ditch 11-G and at extreme upper end.

10. Complete junction of Sewer 11-G-11 with Ditch 11-G and backfill over this sewer to insure complete drainage.

11. Install  $\frac{1}{2}$  round invert tile in Ditches 11-P-1, 11-P-2, and 11-P-2-A, with minimum fill on each side of these Ditches to drain adjacent areas to them.

12. Fill ruts, holes, etc., incident to construction of above items.





Recommended \_\_\_\_\_  
Major, Sanitary Corps

Approved \_\_\_\_\_  
Colonel, Medical Corps







NOTE: Notations in circles thus (b1) refer to subdivisions of section 6 of accompanying report.

~ LEGEND ~

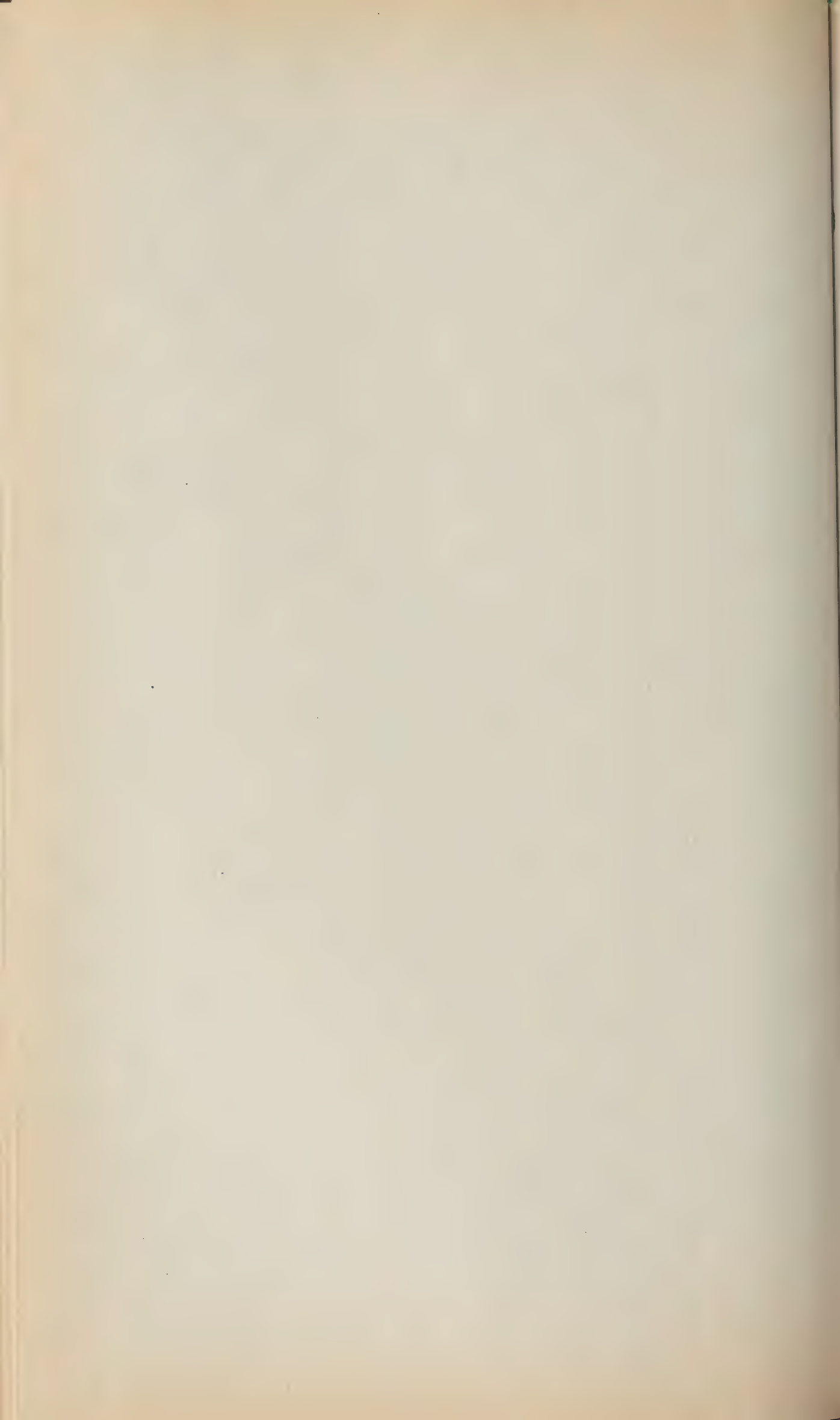
- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

SCALE - Approx. 1" = 2400'

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
ALBROOK, C. Z.

OFFICE OF THE DEPT. SURGEON RECOMMENDED BY: <i>[Signature]</i> CAPT. SAN. CORPS.	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDED
AUGUST 1943	DRWG NO. M-C 4





NOTE: Notations in circles thus, (C9) refer to subdivisions of Section G of accompanying report.



WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL ALBROOK, C Z.	
OFFICE OF THE DEPT. SURGEON RECOMMENDED BY: <i>Wm. H. Hamilton</i> CAPT. SAN CORPS	APPROVED ASST. CHIEF STAFF, G-4
APPROVED: <i>COL. MED. CORPS</i>	DEPUTY DEPT. COMMANDER
AUGUST 1943	DRWG. NO. MC-5







NOTE: Notations in circles thus, (C8) refer to subdivisions or section 6 of accompanying report

# ~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

SCALE: Approx. 1:2400

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
ALBROOK, C. Z.

OFFICE OF THE DEPT. SURGEON RECOMMENDED <i>George W. Hamilton</i> CAPT. SAN CORPS	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER
AUGUST 1943	DRWG NO. M C 10





MALARIA CONTROL - DRAINAGE SURVEYS

REVISED REPORT COVERING  
OUTLYING AREA ALONG CLAYTON-ALBROOK HIGHWAY  
(AREA NUMBER FIVE)



MALARIA CONTROL  
DRAINAGE SURVEYS  
AUGUST 1944

Revised report on outlying area along Clayton-Albrook Highway (Area Number Five) listing work for inclusion in the \$400,000 Malaria Control Project (F.Y. 1945), Chiva Chiva Signal Corps also included. Reference Map M.C. 9, attached hereto. Preliminary estimated cost \$41,250.

1. Pave invert and side slopes of following Ditches:

(a) Ditch 12-G-4 from two 36" culverts about 200 feet downstream from junction with Ditch 12-G-4-C to a point 100 feet upstream from junction with 12-G-4-L.

(b) Ditch 45 from 6x10.5' culvert at junction with Ditch 45-K to fence around gasoline storage area located about 400 feet upstream from junction with Ditch 45-T.

(c) Ditch 45-K from junction with Ditch 45 to fence around gasoline storage area.

Above ditches to be straightened where required to remove abrupt changes in direction and abandoned sections of channels to be backfilled to insure complete drainage. Adjacent banks to be regraded where required to drain to paved ditches. Inverts of ditches may be 12" or larger precast concrete tile or may be monolithic concrete slightly pitched to center. Side slopes may be precast or monolithic concrete provided with frequent weepholes where required.

2. Install 14"  $\frac{1}{2}$  round invert tile laid to maximum practicable grade in the following ditches:

(a) Ditch 11-L-13 from junction with Ditch 11-L to the 24" culvert at junction with Ditch 11-L-13-A.

(b) Ditch 11-L-13-A from junction with Ditch 11-L-13 to a point 100 feet upstream from this point.

(c) Ditch 11-L-13-B from junction with Ditch 11-L-13 to the next two 24" culverts.

(d) Ditch 11-L-14 from junction with Ditch 11-L to 60" culvert at junction with Ditch 11-L-14-D

(e) Ditch 12-G-4-C from junction with Ditch 12-G-4 to next culvert under road.



(f) Ditches 12-G-4-D and 12-G-4-E from junctions with Ditch 12-G-4 to end.

(g) Ditch 12-G-4-D-2 from junction with Ditch 12-G-4-D to end.

(h) Ditch 12-G-4-F from junction with Ditch 12-G-4 to a point 250 feet upstream from junction with Ditch 12-G-4-F-2.

(i) Ditches 12-G-4-f-1, 12-G-4-F-1-A, and 12-G-4-F-1-B.

(j) Ditch 12-G-4-F-2 from junction with Ditch 12-G-4-F to a point 300 feet upstream from this junction.

(k) Ditch 12-G-4-G from junction with Ditch 12-G-4 to a point 700 feet upstream from this junction.

(l) Ditches 12-G-4-H, 12-G-4-J, and 12-G-4-L.

(m) Ditch 45-H from junction with Ditch 45 to a point 700 feet upstream from two 24" culverts under Clayton-Albrook Highway.

(n) Ditches 45-H-1 and 45-H-2 from junction with Ditch 45-H to culverts under Clayton-Albrook Highway.

(o) Ditch 45-H-3 from junction with Ditch 45-H to a point 250 feet upstream from this junction. Include the two short tributaries to this Ditch along the road in Supply Section Storage Yard.

(p) Ditch 45-L from junction with Ditch 45 to a point 200 feet upstream from 24" culvert in this Ditch.

(q) Ditch 45-M from junction with Ditch 45 to a point 250 feet upstream from this junction.

(r) Ditch 45-S from junction with Ditch 45 to fence around gasoline storage area.

3. Complete restoration of terrain in the Chiva Chiva Signal Corps Area to its original condition so that complete drainage will be maintained. Work to include filling of ruts, depressions, borrow pits, etc. Cost of work not to exceed \$3,000.

4. Fill ruts, holes, depressions, etc., incident to construction of above items.

Recommended \_\_\_\_\_

Major, Sanitary Corps

Approved \_\_\_\_\_

Colonel, Medical Corps.



NOTE: Notations in circles thus (C) refer to subdivisions of section 8 of accompanying report.

LEGEND

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT
- SCALE: Approx 1:5000

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
OUTLYING AREA ALONG  
ALBROOK-CLAYTON HIWAY

DRAWINGS BY ENGINEERING SECTION, R.E.D.		RECOMMENDED: CAPT. W. H. HAMILTON CAPT. SAN. CORPS		APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT. COMMANDER	
DRAWN BY: H. A. K. A.		SUBMITTED BY: CAPT. C. E. E.		AUGUST 1943	
				DRW'G NO. 21C-9	

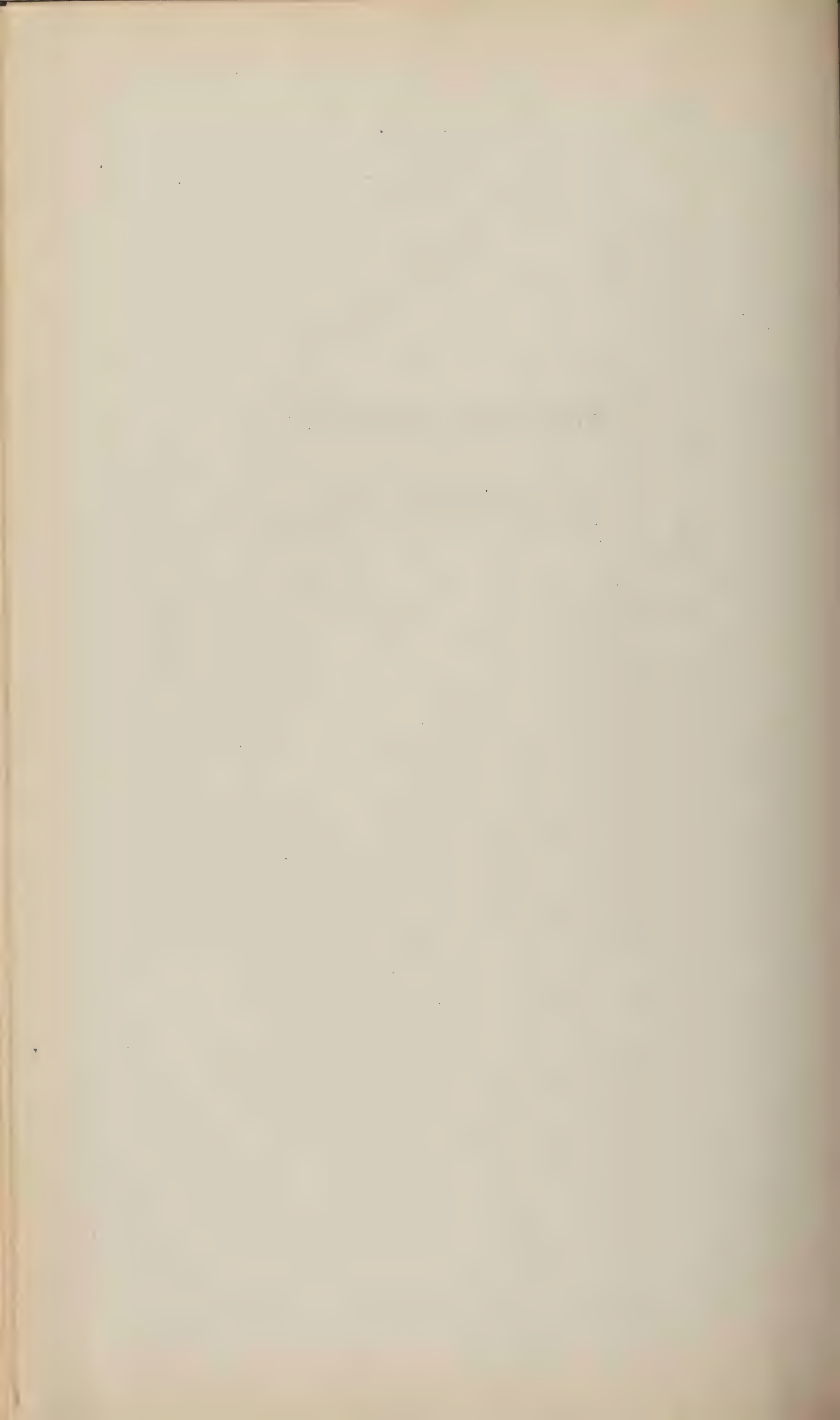






MALARIA CONTROL - DRAINAGE SURVEYS

REVISED REPORT COVERING  
FT. KOBEE-HOWARD FIELD - AREA NUMBER SIX



MALARIA CONTROL

DRAINAGE SURVEYS

AUGUST 1944

Revised report on Fort Kobbe-Howard Field ( Area Number Six), listing work for inclusion in the \$400,000 Malaria Control Project (F.Y. 1945). Reference Maps M.C. 10, M.C. 11, and M.C. 13, attached hereto. Preliminary Estimated cost \$71,650.

1. Pave invert and side slopes of following Ditches:

(a) Ditch 50 from inlet to three 30" culverts at junction with Ditch 50-E to junction with Ditch 50-K.

(b) Ditch 50-B from a point 200 feet downstream from the two 36" culverts (near junction with Ditch 50-B-3) to the three 24" culverts (400 feet upstream from junction with Ditch 50-B-10).

(c) Ditch 50-C-1 from junction with Ditch 50 c-1-A to point of existing paved ditch 100 feet downstream from junction with 50-C-1-D.

(d) Ditch 50-E from junction with Ditch 50 to two 30" culverts under Howard Avenue.

(e) Ditch 51-A from junction with Ditch 51 to 30" culvert under taxiway.

(f) Ditch 51-C from junction with Ditch 51 to junction with 51-C-2.

(g) Ditch 51-C-2 from junction with Ditch 51-C to 36" culvert under taxiway.

(h) Ditch 51-F-4 from junction with Ditch 51-F to 30" culvert under taxiway.

(i) Ditch 54 from a point 200 feet downstream from junction with 54-A to the three 24" culverts near junction with 54-D.

(j) Ditch 55 from junction with Ditch 55-A to point of existing paved ditch about 400 feet upstream from junction with 55-C.



(k) Ditch 55-C-1 for the 200 ft. section between two 24" culverts in rear of nurses' quarters.

(l) Ditch 55-C from junction with Ditch 55 to next 30" culvert.

(m) Ditch 57 from a point 500 feet downstream from junction with Ditch 57-A to junction with Ditch 57-F.

(n) Ditch 58-D from junction with Ditch 58 to the 24" culvert under taxiway.

(o) Ditch 50-D-2 from junction with Ditch 50-D to the 24" culvert under Howard Avenue.

(p) Ditch 58 from a point 300 feet downstream from 8x8' culvert under Howard Avenue to junction with 58-D.

(q) Ditch 53-A from junction with Ditch 53-A-1 (tide-water level) to junction with Ditch 53-A-5.

Above ditches to be straightened where required to remove abrupt changes in direction and abandoned sections of channels to be backfilled to insure complete drainage. Adjacent banks to be regraded where required to drain to paved ditches. Inverts of ditches may be 12" or larger precast invert tile or may be monolithic concrete with bottoms slightly pitched to the center. Side slopes may be precast or monolithic concrete provided with frequent weepholes where required.

2. Regrade Ditch 50 from junction with Ditch 50-B to the three 30" culverts near junction with Ditch 50-E.

3. Reset one of the three 30" culverts in Ditch 50 at junction with Ditch 50-E with outlet elevation 0.5 feet lower than at present and inlet elevation 1.0 feet lower than at present.

4. Install 14"  $\frac{1}{2}$  round invert tile laid to maximum practicable grade in following Ditches:

(a) Ditch 50 from junction with Ditch 50-K to 4x4' culvert at junctions with 50-Q.

(b) Ditches 50-C-1-A, 50-C-1-B, 50-C-1-C, and indicated tributaries.

(c) Ditch 50-E-1 from junction with Ditch 50-E to junction with Ditch 50-E-1.

(d) Ditch 50-M from junction with Ditch 50 to point of existing paving about 200 feet above this junction.

(e) Ditch 51-C from junction with Ditch 51-C-2 to end.

(f) Ditch 51-C-3 from junction with Ditch 51-C to a point 300 feet upstream from this junction.

(g) Ditch 51-D from junction with Ditch 51 to end.

(h) Ditch 51-F-4-A from junction with Ditch 51-F-4 to end.

(i) Ditch 51-F-4-C from junction with Ditch 51-F-4 to end.

(j) Ditch 57 from junction with Ditch 57-F to end.

(k) Ditch 54-C from junction with Ditch 54 to a point 50 feet upstream.

(l) Ditch 55-A from junction with Ditch 55 to next 24" culvert.

(m) Ditch 55-A-1 from junction with Ditch 55-A to point of existing paving about 150 feet upstream.

(n) Ditch 58-D-2 from junction with Ditch 58-D to a point 600 feet upstream from this junction.

(o) Ditch 51-F-5 from junction with Ditch 51-F to 18" culvert at junction with 51-F-5-B.

(p) Ditch 51-F-5-A from junction with Ditch 51-F-5 to 15" culvert under road.

(q) Ditch 51-F-6 from junction with Ditch 51-F to a point 300 feet upstream from this junction.

(r) Ditch 51-F-7 from junction with Ditch 51-F to 24" culvert at junction with 51-F-7-C.

(s) Ditch 53-A from junction with Ditch 53-A-5 to 20" culvert at junction with Ditch 53-A-8.

(t) Ditches 53-A-2, 53-A-3, 53-A-5, 53-A-6, and indicated tributaries.

(u) Ditch 53-A-7 from junction with Ditch 53-A to next culvert under road. Include indicated tributaries.

5. Complete minor regrading job about 200 feet south of junction of Ditches 51-F-4 and 51-F-4-D.

6. Fill area at end of Ditch 51-F-4-A to minimum depth required to drain into Ditch.

7. Fill old ditch channel crossing Ditch 51-A near lower end to minimum depth required to drain into ditch.

8. Complete minor regrading job at south end of West runway, projected.

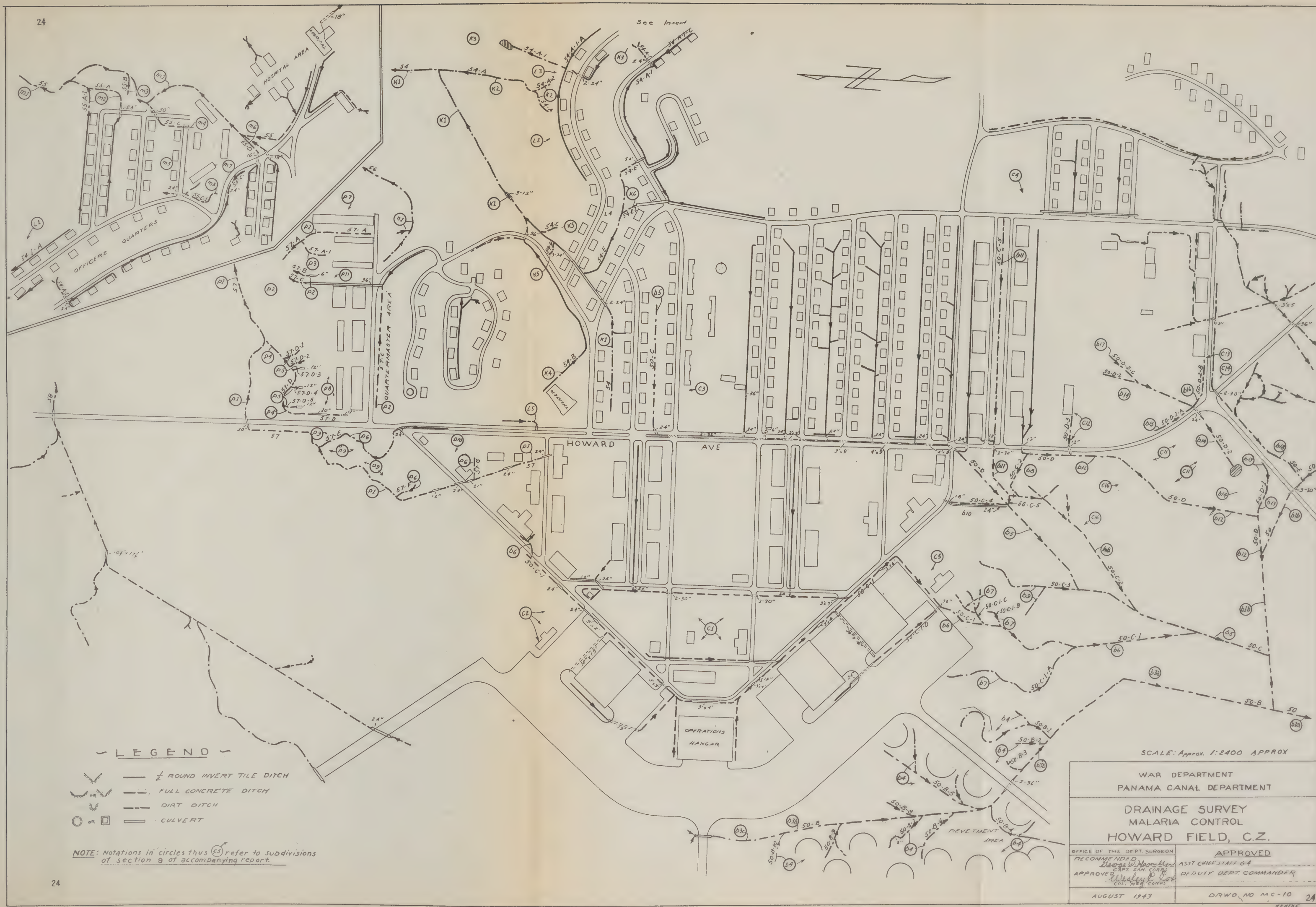
9. Fill ruts, holes, etc., incident to construction of above items.



Recommended \_\_\_\_\_  
Major, Sanitary Corps

Approved \_\_\_\_\_  
Colonel, Medical Corps











NOTE: Notations in circles thus (h3) refer to subdivisions of section 9 of accompanying report.

# ~ LEGEND ~

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- CULVERT

SCALE: 1" = 200' APPROX

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
HOWARD FIELD, C.Z.

OFFICE OF THE DEPT. SURGEON  
RECOMMENDED  
APPROVED  
CAPT. MED. CORPS.

APPROVED

SEPT. 1943

DRAWING NO. MC-11

25

















MALARIA CONTROL - DRAINAGE SURVEYS

REVISED REPORT COVERING  
FT. DAVIS - AREA NUMBER ELEVEN





## MALARIA CONTROL

### DRAINAGE SURVEYS

AUGUST 1944

Revised report on Fort Davis (Area Number Eleven) listing work for inclusion in the \$400,000 Malaria Control Project (F.Y. 1945) Reference Maps M.C. 18 and M.C. 19 attached hereto. Preliminary Estimated Cost \$39,950.

1. Pave invert and side slopes of following Ditches.

(a) Ditch 96 from 7"x15' culvert at junction with 96 - Q to junction with ditch 96-R.

(b) Ditch 97 from 42'x10' culvert at Bolivar Highway to junction with Ditch 97-V.

(c) Ditch 97-F from junction with Ditch 97 to culvert near junction with 97-F-8 and from 24" culvert near junction with Ditch 97-F-16 to junction with Ditch 97-F-20.

(d) Ditch 97-F-14 from junction with Ditch 97-P to a point 200 ft. upstream from junction with Ditch 97-F-14-C.

(e) Ditch 97-T from junction with Ditch 97 to 24" culvert at end.

(f) Ditch 97-V from junction with Ditch 97 to existing paved section about 200 ft. upstream.

Above ditches to be straightened where required to remove abrupt changes in direction and abandoned sections of channels to be backfilled to insure complete drainage. Adjacent banks to be regraded where required to drain to paved ditches. Especial care shall be taken to minimize damage to the golf course adjacent to certain of these ditches and the golf course shall be left in a condition upon completion of work equal to its condition at the start of the work. Inverts of ditches may be 12" or larger precast concrete tile or may be monolithic concrete slightly pitched to center. Side slopes may be precast or monolithic concrete provided with frequent weepholes where required.

2. Install  $\frac{1}{2}$  round invert tile laid to maximum practicable grade in following Ditches:

(a) Ditch 97-F from junction with Ditch 97-F-20 to end of Ditch.

(b) Ditch 97-F-14-C from relocated Ditch 97-F-14 to point of existing paving.

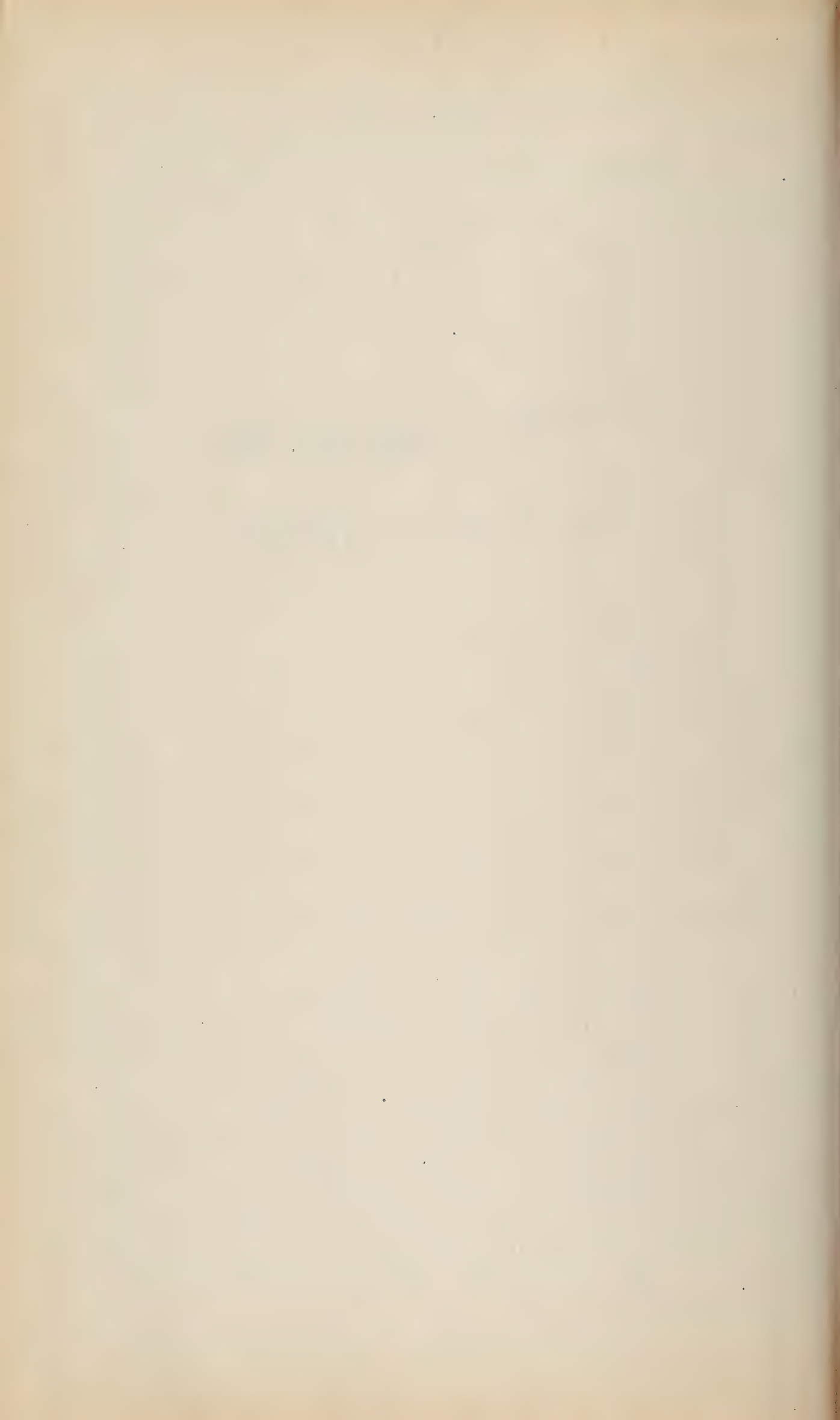
(c) Ditches 97-F-18 and 97-F-19.

3. Fill ruts, holes, etc., incident to construction of above items.

Recommended \_\_\_\_\_  
Major, Sanitary Corps

Approved \_\_\_\_\_  
Colonel, Medical Corps















MALARIA CONTROL - DRAINAGE SURVEYS

REVISED REPORT COVERING  
FRANCE FIELD - AREA NUMBER FOURTEEN





DRAINAGE SURVEY

MALARIA CONTROL

AUGUST 1944

Revised report on France Field (Area Number Fourteen) listing work for inclusion in the \$400,000 Malaria Control Project (F.Y.1945). Reference Maps M.C. 23, M.C. 24, M.C. 25, and M.C. 26, attached hereto. Preliminary estimated cost \$89,100.

1. Pave invert and side slopes of following ditches:

(a) Ditch 123 from junction with Ditch 123-Q to a point 1200 feet upstream from inlet to the two 60" culverts under South end of runway.

(b) Ditch 123-D from junction with Ditch 123-D-1 to junction with Ditch 123-D-6.

(c) Ditch 123-Q from junction with Ditch 123 to 24" culvert under runway.

(d) Ditch 123-Q-3 from junction with Ditch 123-Q to 36" culvert under taxiway.

(e) Ditch 123-V from junction with Ditch 123 to Ditch 123-V-2.

(f) Ditch 123-W from junction with Ditch 123 to end.

(g) Ditch 123-Y from junction with Ditch 123 to a point 500 feet upstream from this junction.

(h) Ditch 127 from junction with Ditch 127-B to junction with 127-C.

(i) Ditch 127 from junction with Ditch 127-C to the 36" culvert under runway.

(j) Ditch 127-C from junction with Ditch 127 to a point 200 feet upstream from junction with Ditch 127-C-1.

(k) Ditch 127-C-1 from junction with Ditch 127-C to 60" culvert at junction with 127-C-1-B.

(l) Ditch 134 from Naval property line near junction with Ditch 134-A to outlet of 60" culvert near junction with Ditch 134-C.

(m) Ditch 134 from inlet to 30" culvert at junction with Ditch 134-E to junction with Ditch 134-J.

(n) Ditch 134-J from junction with Ditch 134 to Naval fence line about 200 feet upstream from 30" culvert under by-pass road.

(o) Ditch 133 from West fence around fuel storage area to a point 1300 feet upstream from this fence.

(p) Ditch 122 from junction with Ditch 122-T to the two 24" culverts under taxiway.

(q) Ditch 123-S from junction with Ditch 123 to junction with Ditch 123-S-1.

(r) Ditch 127-B-1 from junction with Ditch 127-B to next 18" culvert.

Above ditches to be straightened where required to remove abrupt changes in direction and abandoned sections of channels to be backfilled to insure complete drainage. Adjacent banks to be regraded where required to drain to paved ditches. Inverts of ditches may be 12" or larger precast concrete tile or may be monolithic concrete slightly pitched to the center. Side slopes may be precast or monolithic concrete provided where required with frequent weepholes.

2. Fill following abandoned ditch channels to minimum depth required for drainage and install  $\frac{1}{2}$  round invert tile in them to provide local drainage:

(a) Ditch 127-A

(b) Ditch 129

(c) Ditch 129-A

(d) Ditch 130

(e) Ditch 123-D-4 from junction with Ditch 123-D-4-B to end.



3. Lower 30" culvert in Ditch 134 to junction with Ditch 134-E if required to obtain a steeper gradient for Ditch 134 for section between this culvert and junction with Ditch 134-J.

4. Lower 30" culvert in Ditch 134-J under by-pass road.

5. Fill Ditches 123-D-4-A, 123-R, 123-V-4, 123-V-1, and 123-V for section above junction with 123-V-2.

6. Fill following areas to minimum depth required to drain to adjacent paved ditches:

(a) Each side of Ditch 123-D-4-B.

(b) Each side of Ditch 123-D from a point about 250 feet downstream from junction with Ditch 123-D-6 to end.

(c) Each side of Ditch 123-D-6 from junction with Ditch 123-D to a point about 250 feet upstream from this junction.

(d) Each side of Ditch 123-V from junction with Ditch 123 to junction with Ditch 123-V-2

(e) Triangle between Ditches 123-V and 123-W.

(f) Triangle between Ditches 123-V and 123.

(g) Along south bank of Ditch 123-W.

(h) Along each side upper section of Ditch 127-E.

(i) Along each side ditch 134-J upstream from 30" culvert.

7. Install 12"  $\frac{1}{2}$  round invert tile laid to maximum practicable grade in following ditches:

(a) Ditch 123-Q-1 and indicated tributaries.

(b) Ditch 123-T for about 100 feet from junction with Ditch 123.

(c) Ditch 123-U for 450 feet above junction with Ditch 123.

(d) Ditch 123-V-2 upstream from junction with 123-V

(e) Ditches 123-V-2-A and 123-V-2-A-1.

(f) Ditches 123-X, 123-X-1, and 123-Y-1.

(g) Ditch 123-D upstream from junction with Ditch 123-D-6.

(h) Ditch 123-D-4 from junction with Ditch 123-D to junction with 123-D-4-B.

(i) Ditch 123-D-4-B.

(j) Ditch 123-D-6 from junction with Ditch 123-D to junction with Ditch 123-D-6-A.

(k) Ditch 127-C-1-A and tributary.

(l) Ditch 127-C-1-B.

(m) Ditches 127-E and 127-D.

(n) Ditch 134 from junction with Ditch 134-J to 24" culvert under by-pass road.

(o) Ditches 134-F, 134-G, 134-H, and 134-K.

8. Fill extensive holes and depressions in area located about 1000 feet northeast of junction of Ditches 122 and 122-T with 14"  $\frac{5}{8}$  round invert tile drain from the two major seepage areas in this area to junction of Ditch 122-H and 122-H-3.

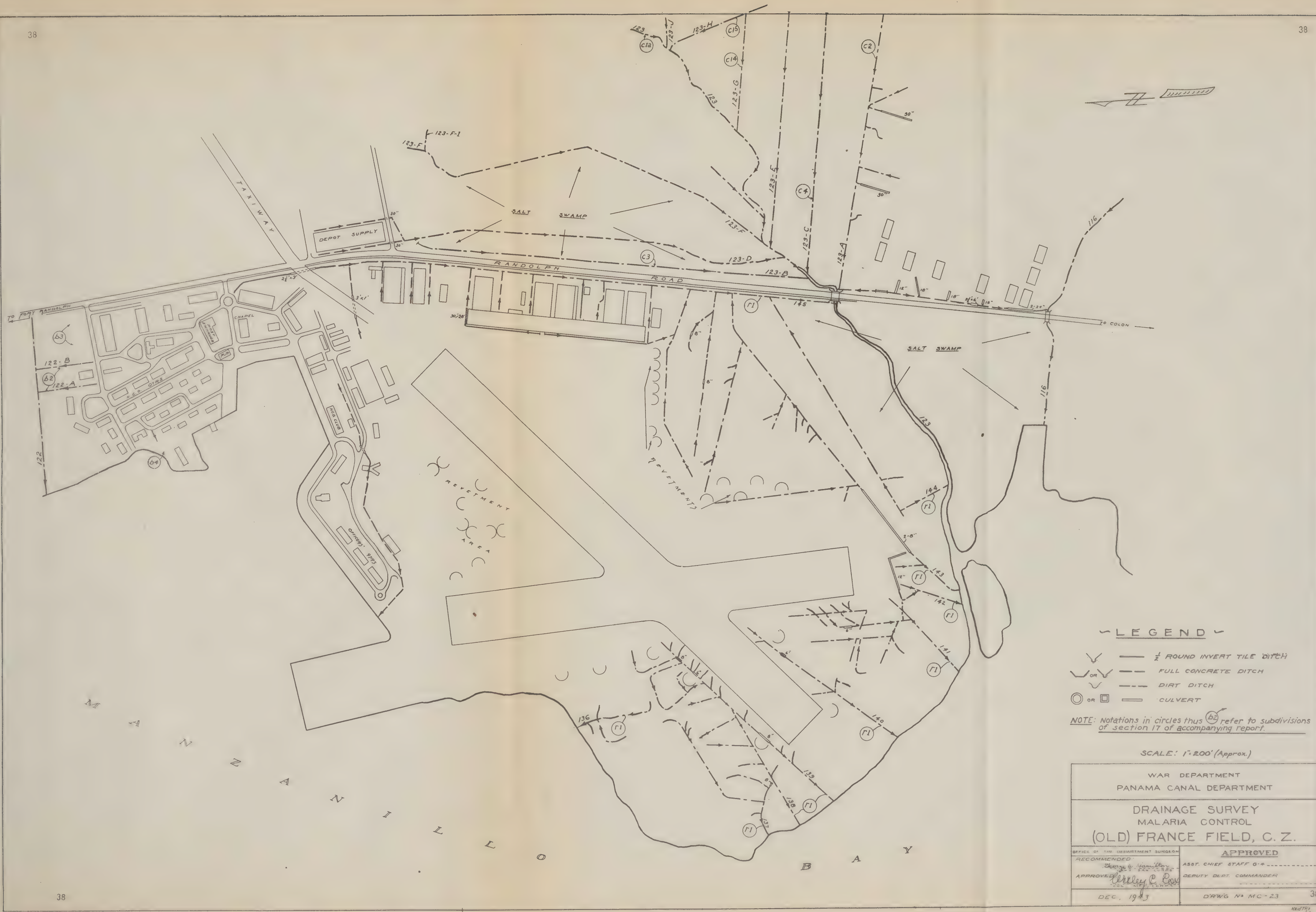
9. Fill ruts, holes, etc., incident to construction of above items.

Recommended \_\_\_\_\_  
Major, Sanitary Corps

Approved \_\_\_\_\_  
Colonel, Medical Corps

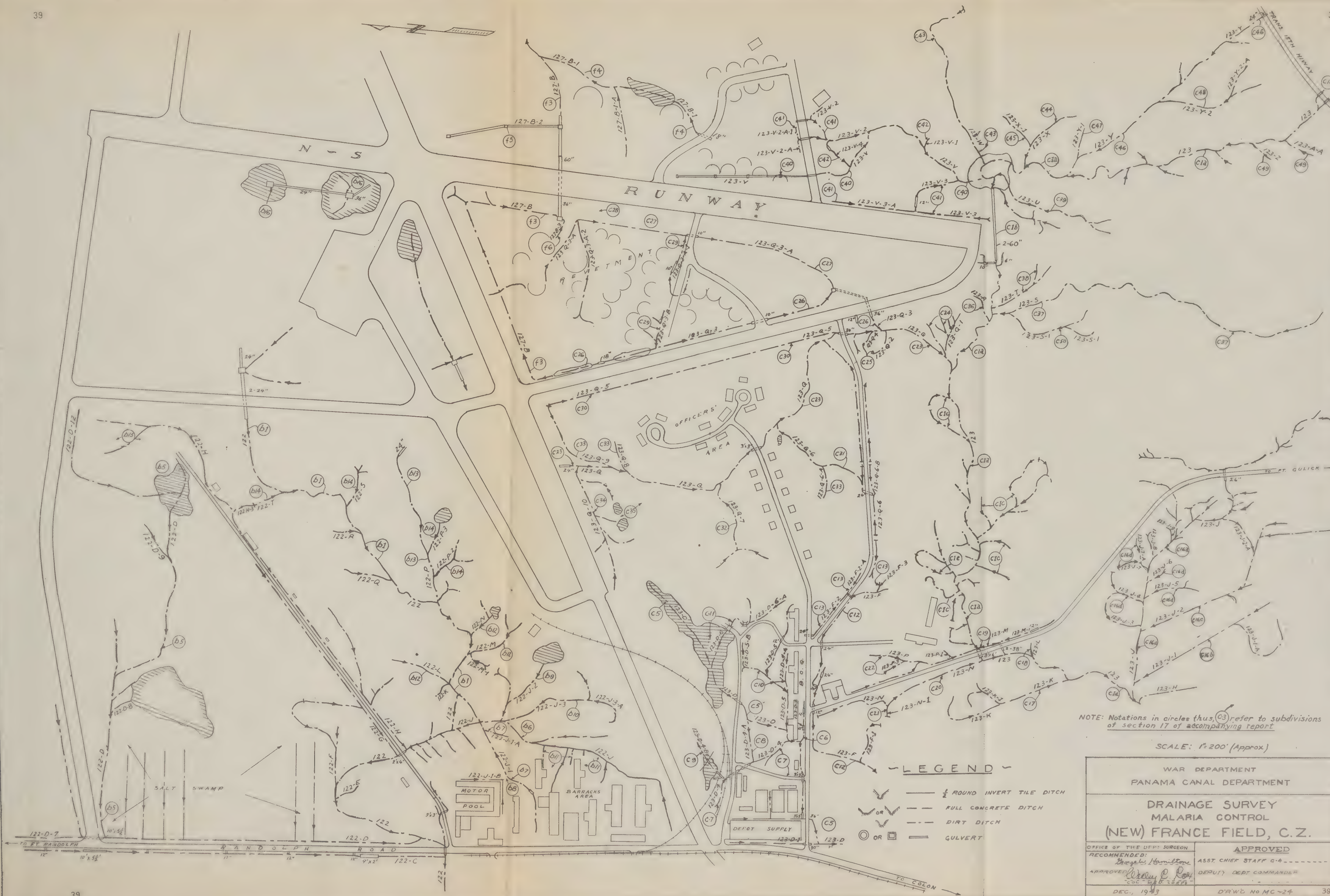












NOTE: Notations in circles thus, C3 refer to subdivisions of section 17 of accompanying report

SCALE: 1"=200' (Approx)

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

**DRAINAGE SURVEY  
MALARIA CONTROL  
(NEW) FRANCE FIELD, C.Z.**

OFFICE OF THE DEPT SURGEON RECOMMENDED: <i>Charles Hamilton</i>	APPROVED ASST. CHIEF STAFF G-4 DEPUTY DEPT COMMANDER
APPROVED: <i>Charles P. Ray</i> COL. 540 5500	DEC. 1943







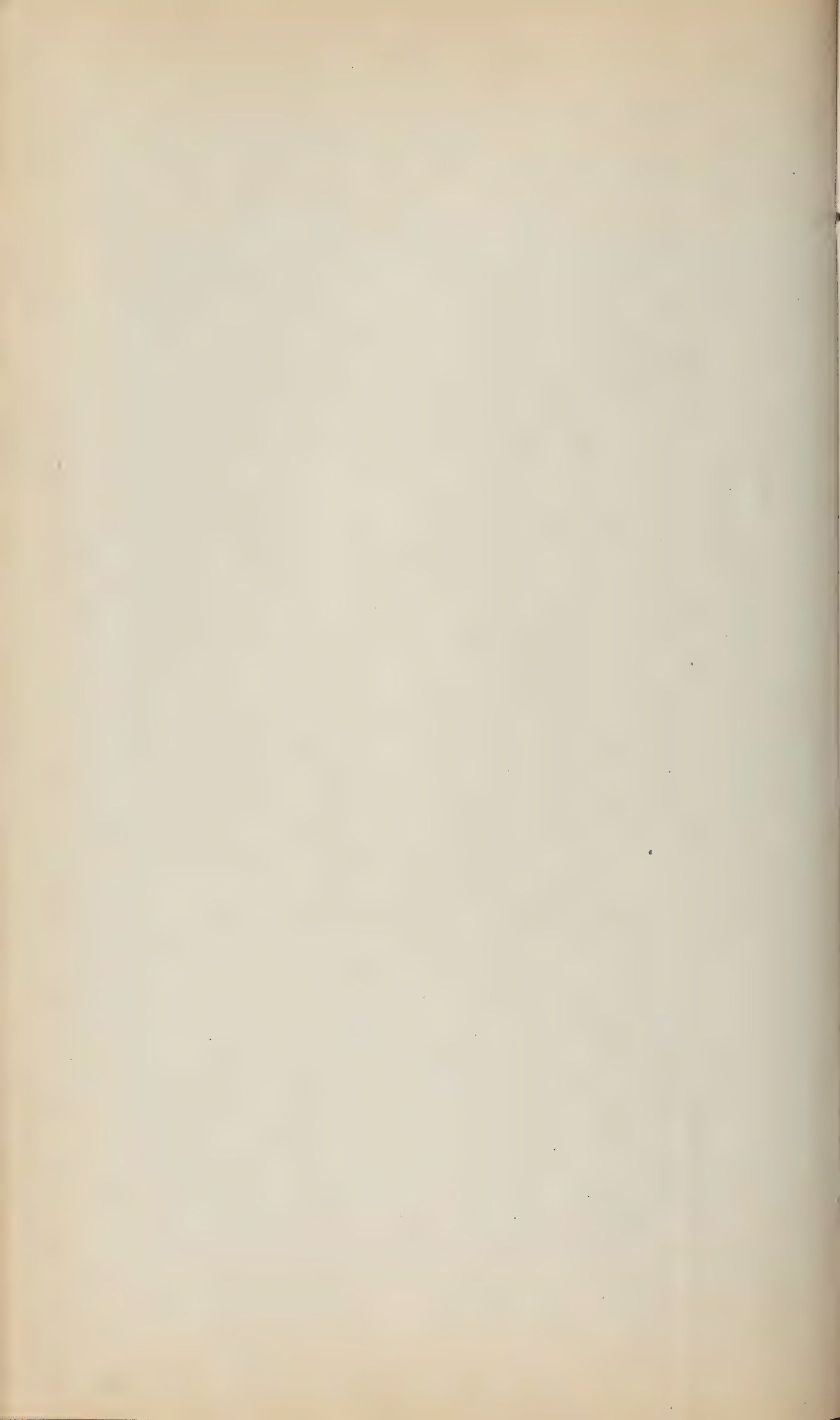
NOTE: Notations in circles thus (128) refer to subdivisions of section 17 of accompanying report.

SCALE: 1"=200' (Approx.)

- ~ LEGEND ~
- ROUND INVERT TILE DITCH
  - FULL CONCRETE DITCH
  - DIRT DITCH
  - CULVERT

WAR DEPARTMENT PANAMA CANAL DEPARTMENT	
DRAINAGE SURVEY MALARIA CONTROL FRANCE FIELD, C. Z.	
OFFICE OF THE DEPARTMENT SURGEON RECOMMENDED: <i>Charles W. Hamilton</i> APPROVED: <i>Andrew C. Cox</i>	APPROVED ASST. CHIEF STAFF G-5 DEPUTY DEPT. COMMANDER
JAN., 1944	
DRW'G NO MC-25	





COCO SOLO NAVAL

RESERVATION



NOTE: Notations in circles thus (P1) refer to subdivisions of section 17 of accompanying report

LEGEND

- 1/2 ROUND INVERT TILE DITCH
- FULL CONCRETE DITCH
- DIRT DITCH
- OR □ CULVERT

SCALE: 1"=200' (Approx.)

WAR DEPARTMENT  
PANAMA CANAL DEPARTMENT

DRAINAGE SURVEY  
MALARIA CONTROL  
FRANCE FIELD, C.Z.

OFFICE OF THE DEPARTMENT SURGEON  
RECOMMENDED:  
George W. Hamilton  
CAPT. SAN. CORPS  
APPROVED:  
C. B. O'Connell  
COL. MED. CORPS

APPROVED  
ASST. CHIEF STAFF G-4  
DEPUTY DEPT. COMMANDER

FEB. 1944

DRWG NO MC-26

41

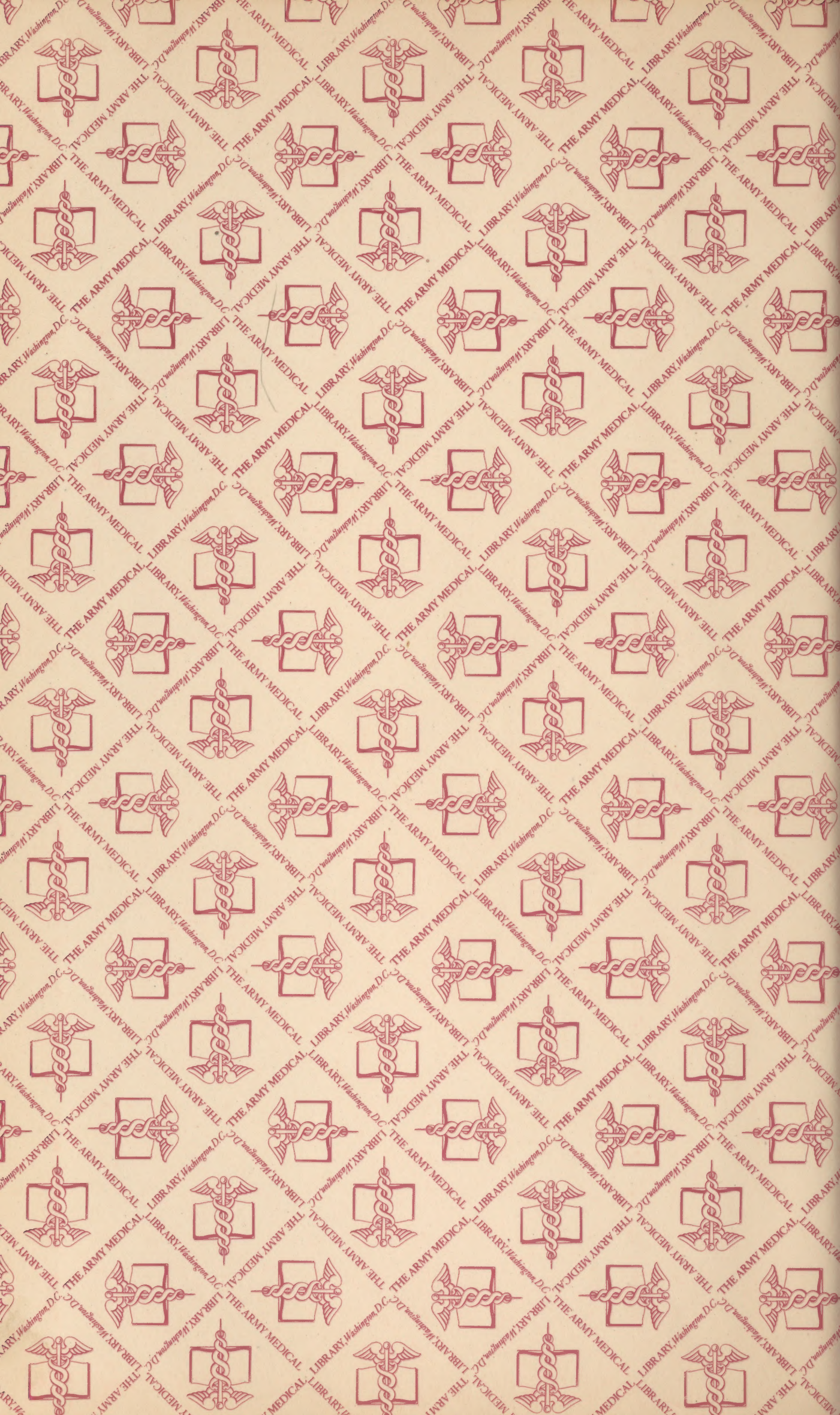
HEATSE

Arnold

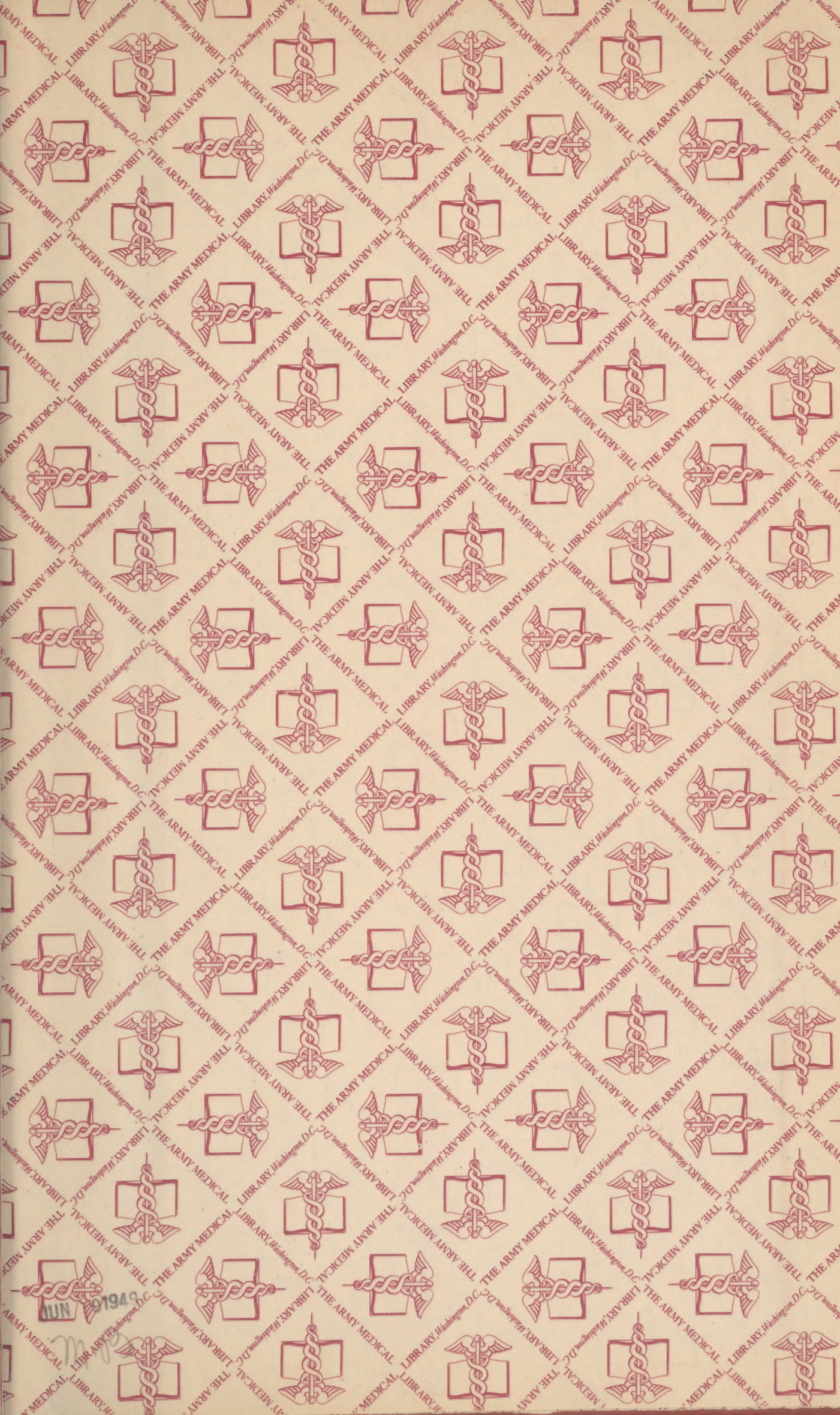












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